























THE  
JOURNAL  
OF THE  
ROYAL AGRICULTURAL SOCIETY  
OF ENGLAND.

VOLUME THE TWENTY-FIFTH.

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PRACTICE WITH SCIENCE.

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THESE EXPERIMENTS, IT IS TRUE, ARE NOT EASY; STILL THEY ARE IN THE POWER OF EVERY THINKING HUSBANDMAN. HE WHO ACCOMPLISHES BUT ONE, OF HOWEVER LIMITED APPLICATION, AND TAKES CARE TO REPORT IT FAITHFULLY, ADVANCES THE SCIENCE, AND, CONSEQUENTLY, THE PRACTICE OF AGRICULTURE, AND ACQUIRES THEREBY A RIGHT TO THE GRATITUDE OF HIS FELLOWS, AND OF THOSE WHO COME AFTER. TO MAKE MANY SUCH IS BEYOND THE POWER OF MOST INDIVIDUALS, AND CANNOT BE EXPECTED. THE FIRST CARE OF ALL SOCIETIES FORMED FOR THE IMPROVEMENT OF OUR SCIENCE SHOULD BE TO PREPARE THE FORMS OF SUCH EXPERIMENTS, AND TO DISTRIBUTE THE EXECUTION OF THESE AMONG THEIR MEMBERS.

VON THAER, *Principles of Agriculture.*

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## LIST OF GOVERNORS AND MEMBERS.

## DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios, and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume: the lettering at the back to include a statement of the *year* as well as the *volume*; the first volume belonging to 1839-40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete), were omitted; the Roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

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STATISTICS  
OF  
THE WEATHER, PUBLIC HEALTH, PRICE OF  
PROVISIONS, &c., &c.,  
FOR THE SIX MONTHS ENDING JUNE 30, 1864.

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*Chiefly extracted from the Quarterly Report of the Registrar-General.—  
The Corn Returns are prepared from Official Documents expressly for this  
Journal.*

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ON

## THE METEOROLOGY OF ENGLAND

DURING

THE QUARTER ENDING MARCH 31, 1864.

BY JAMES GLAISHER, Esq., F.R.S.,

SEC. OF THE BRITISH METEOROLOGICAL SOCIETY.

THE year 1863 closed with very fine weather for the season all over the country, which had continued for several weeks. At the beginning of January 1864 the weather changed, and till the 9th it was exceedingly cold, averaging a daily deficiency of  $8\frac{1}{2}^{\circ}$ . On the 10th a period of warm, damp, and foggy weather set in, and till February 3 there was an average daily excess of  $3\frac{1}{2}^{\circ}$  of temperature. On February 4 a cold period set in, lasting till the 11th; five days warm weather followed, ending the 16th; the daily excess,  $6\frac{1}{4}^{\circ}$  nearly. From February 17th the weather was altogether wintry, and the average daily deficiency for 16 days, ending March 3, was  $4\frac{1}{2}^{\circ}$ . From March 4 to 15 the weather was warm, with an excess of  $2\frac{3}{4}^{\circ}$  daily; from March 16 to the end of the quarter the deficiency was  $2^{\circ}$ . During the quarter there was an unusual number of alternations in temperature.

The mean high day temperature was below the average to the amount of  $1^{\circ}9$ ,  $3^{\circ}6$ , and  $0^{\circ}4$  respectively in these three months. The mean low night temperature was below the average to the amount of  $1^{\circ}9$ ,  $2^{\circ}4$ , and  $1^{\circ}3$  respectively. Therefore both the days and nights were cold in these three months.

The mean temperature of the air in January was  $1^{\circ}8$ , in February  $2^{\circ}9$ , and in March  $0^{\circ}7$  below the respective averages of the preceding 23 years.

The mean temperature of the dew-point was  $4^{\circ}0$ ,  $3^{\circ}5$ , and  $0^{\circ}6$  below the averages of the preceding 23 years.

The degree of humidity was less than its average in January and February, and a little above in March.

The pressure of the atmosphere was a little more than  $\frac{1}{4}$  in. in excess in January, somewhat in defect in February, and about  $\frac{1}{4}$  in. in March.

The fall of rain was in defect in January and February to the amount of 0.9 in. and 0.8 in. respectively, and in excess to the amount of 1.2 in. in March.

The mean temperature of the air at Greenwich in the three months ending February, constituting the three winter months, was  $38^{\circ}6$ , being  $0^{\circ}7$  above the average of the preceding 93 years.



## THE WEATHER DURING THE QUARTER ENDING MARCH 31, 1864.

1864. MONTHS.		Temperature of										Weight of Vapour in a Cubic Foot of Air.				
		Alr.		Evaporation.		Dew Point.		Alr—Daily Range.		Elastic Force of Vapour.						
		Mean.	Diff. from average of 93 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.			
January ..	36.5	+0.3	34.4	0	31.3	0	9.7	0	0.0	in.	grs.	gr.				
February ..	36.0	-2.3	34.1	-3.1	31.3	-4.0	10.3	-1.2	0.0	.176	.176	-0.4				
March ...	41.3	+0.3	39.1	-0.7	36.2	-0.6	15.5	+0.8	0.0	.215	.004	0.0				
Mean ..	37.9	-0.6	35.9	-2.2	32.9	-2.7	11.8	-0.1	0.0	.189	.020	-0.3				
1864. MONTHS.		Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Alr.		Rain.		Tempera- ture of Water of the Thames.		Number of Nights it was			Reading of Thermometer on Grass.	
		Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Amount.	Diff. from average of 23 years.	At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.		
		Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	
January ..	82	-7	30.044	in.	grs.	in.	0.9	in.	0	39.7	18	10	3	0	43.1	
February ..	88	-2	29.760	+0.284	561	+7	0.8	-0.9		38.5	18	11	0	12.1	37.3	
March ...	83	+1	29.503	-0.044	557	+3	2.7	+1.2		43.0	18	12	1	19.6	41.3	
Mean ..	83	-3	29.769	-0.009	555	+2	4.4	Sum	Mean	40.4	Sum	Sum	Sum	Lowest	Highest	
								-0.5				33	4	6.0	43.1	

NOTE.—In reading this table it will be borne in mind that the sign (-) minus signifies below the average, and that the sign (+) plus signifies above the average.

ON

## THE METEOROLOGY OF ENGLAND

DURING

THE QUARTER ENDING JUNE 30, 1864.

BY JAMES GLAISHER, Esq., F.R.S.,

SEC. OF THE BRITISH METEOROLOGICAL SOCIETY.

THE quarter ending March closed with cold and changeable weather, which continued to the 8th of April; the average daily deficiency from March 16, to April 8, was  $1^{\circ}8$ . A warm period set in on the 9th, and continued to May 22; the excess for these 44 days was  $3\frac{1}{2}^{\circ}$  nearly. From May 23 to the end of the quarter the weather was cold, with the exception of June 6 to 10; the deficiency for the 39 days, ending June 30, amounted to  $2\frac{1}{2}^{\circ}$  nearly daily.

The mean temperature of April was  $48^{\circ}2$ , being  $1^{\circ}7$  above the average of the preceding 23 years.

The mean temperature of May was  $53^{\circ}8$ , being  $0^{\circ}9$  above the average of 23 years.

The mean temperature of June was  $57^{\circ}4$ , being  $1^{\circ}7$  below the average of 23 years.

The mean high day temperatures for the months of April, May, and June were  $58^{\circ}3$ ,  $64^{\circ}8$ , and  $69^{\circ}5$ , being  $1^{\circ}3$  above,  $0^{\circ}3$  below, and  $1^{\circ}4$  below their respective averages. The mean low night temperatures for these three months were  $40^{\circ}$ ,  $44^{\circ}9$ , and  $49^{\circ}1$ , being  $1^{\circ}3$  above,  $0^{\circ}7$  below, and  $1^{\circ}1$  below their averages respectively. Therefore both the days and nights were warm in April, and cold in May and June.

The mean temperature of the dew-point was  $0^{\circ}2$  below its average in April, was its average in May, and  $2^{\circ}1$  below it in June.

The degree of humidity was very uniform, and always its average.

The pressure of the atmosphere was in excess in the months of April and May; in the former to less than  $0.2$  in., and in the latter to less than  $0.1$  in.; in June it scarcely differed from its average.

The fall of rain was in defect in each month. It was  $0.7$  in. in April, being  $1.1$  in. too small;  $1.9$  in. in May, being  $0.2$  in. in defect; and  $0.9$  in. in June, or  $1$  in. below the average.

The mean temperature of the air at Greenwich in the three months ending May, constituting the three spring months, was  $47^{\circ}8$ , being  $1^{\circ}3$  above the average of the preceding 93 years.

## THE WEATHER DURING THE QUARTER ENDING JUNE 30, 1864.

1864. MONTHS.		Temperature of						Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.									
		Air.		° Evaporation.		Dew Point.		Air—Daily Range.		Mean.	Diff. from average of 23 years.								
		Mean.	Diff. from average of 93 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.										
April . . . . .	48.2	0	+2.4	44.3	0	+0.8	40.0	0	18.3	0	+0.1	in.	0.248	grs.	2.9	0.0			
May . . . . .	53.8		+1.3	49.7		+0.5	45.6	0.0	19.9		-0.4		0.306		3.5	0.0			
June . . . . .	57.4		-0.7	52.8		-1.9	48.7	-2.1	20.4		-0.3		0.344		3.9	-0.3			
Mean ..	53.1		+1.0	48.9		-0.2	44.8	-0.8	19.5		-0.2		0.299		3.4	-0.1			
1864. MONTHS.		Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Temperature of Water of Thames.	Number of Nights it was			Reading of Thermometer on Grass.					
		Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Mean.	Diff. from average of 23 years.	Amount.	Diff. from average of 47 years.		At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.				
		April . . . . .	74	-5	29.915	+164	547	grs.	+4	in.	0.7	in.	-1.1	8	19	3	0	22.9	45.5
May . . . . .	73	-4	29.837	+084	538		-5		1.9		-0.2	3	9	19		26.4	48.9		
June . . . . .	72	-3	29.792	-007	533		-2		0.9		-1.0	0	12	18		32.1	56.2		
Mean ..	73	-4	29.848	+080	539		-1		3.5	Sum	-2.3	Sum	40	Sum	40	Lowest	22.9	Highest	56.2

NOTE.—In reading this table it will be borne in mind that the sign (-) minus signifies below the average, and that the sign (+) plus signifies above the average.

## STATE OF THE PUBLIC HEALTH.

*1st Quarter.*—The deaths greatly exceeded the average number. Seldom has a winter been more fatal; for 143,030 deaths—1572 a day—were registered in ninety-one days, including the additional day of leap year, for which due correction is made. The mortality was at the rate of 2·773 per cent.; whereas the average of the season in the preceding ten years was 2·490 per cent.; thus the rate was nearly 28 instead of 25 in 1000. 14,698 persons died in excess of the average number. Since 1842 it is only in the two winters (1847-48) after the potato failure, and in the winter of the Crimean war (1855), that the country has experienced any higher rates of mortality. The winter death-rate per 1000 was 2·850, and 2·794 in the former years, 2·910 in 1855, and 2·773 in 1864. London suffered to an extraordinary extent, and is accountable for a large share of the increase. The average annual rate of the winter quarter in London is 2·577 per cent., but in the last winter quarter the rate becomes 3·088, or ·511 above the average. The funerals increased in the proportion of five to six.

*2nd Quarter.*—The deaths which were registered in the quarter that ended on June 30 amounted to 116,899. The number is above the average of the deaths in the months of April, May, and June; but it is less than the number of deaths which were registered in the corresponding quarter of the previous year, and less by 26,131 than the deaths in the three first fatal winter months of this year. Then 1572 deaths were registered daily; in the present quarter the daily deaths have been 1284. The mortality has been at the rate of 2·260 in 100 living, or ·073 above the average of the spring quarters of the previous ten years. The mortality of the town populations has been at the rate of 2·369, and of the country populations 2·110 per cent.: thus the towns lost 18,392 lives, and the country 10,000 lives, in excess of the deaths which would have been registered had the mortality been at the rate prevailing in the least unhealthy districts of England and Wales. As a general rule the three spring months, April, May, June, are healthier than winter, and somewhat less healthy than the summer in ordinary years. They express very closely the average mortality of the year. Thus the average annual mortality per cent. in ten years (1854-63) was 2·214, and in the ten springs of those years, 2·187; it was less in the spring quarters by ·027.

## PRICE OF PROVISIONS.

*1st Quarter.*—Meat more than maintained its price, but both wheat and potatoes were unusually cheap. The mean of the lowest and highest prices of beef as sold at Leadenhall and Newgate was  $5\frac{1}{2}d.$  against  $5\frac{1}{6}d.$  in the same quarter of the two previous years; and of mutton the mean price was  $6\frac{1}{4}d.$ , which is also higher than in either of the two corresponding periods. Wheat declined to  $40s. 4d.$  per quarter, each period of three months since September 1862 having witnessed more or less fall in the price. From the date just specified the fall has caused a difference of  $16s. 6d.$  per quarter. Best potatoes have fallen to a mean price of  $62s. 6d.$  per ton at Southwark against double that price in the first three months of last year.

*2nd Quarter.*—Wheat was unusually cheap. Its average price in the three months was  $39s. 7d.$  per quarter. In the corresponding period of 1862 it was  $56s. 8d.$ ; in that of 1863 it was  $46s. 2d.$  The mean of the highest and lowest prices of beef as sold by the carcase in Leadenhall and Newgate was  $5\frac{1}{4}d.$  per lb., and the same as in the June quarter of last year. Of mutton the mean price was  $6\frac{1}{8}d.$ , being higher than in the same season of 1862-63. The best potatoes were sold from  $2l.$  to  $3l.$  per ton in Southwark. The price was less than half of that for which they had been obtained in the spring of last year, and still lower in proportion to the price of 1862. The working classes enjoyed cheap markets for supplying themselves with the chief necessities of life.



## THE PRICE OF PROVISIONS.

The AVERAGE PRICES of Consols, of Wheat, Meat, and Potatoes; also the AVERAGE QUANTITY of Wheat sold and imported weekly, in each of the Nine Quarters ending June 30, 1864.

Quarters ending	Average Price of Consols (for Money).	Average Price of Wheat per Quarter in England and Wales.	Wheat sold in the 290 Cities and Towns in England and Wales making Returns.*	Wheat and Wheat Flour entered for Home Consumption at Chief Ports of Great Britain.*	Average Prices of		
			Average number of Quarters weekly.	Meat per lb. at Leadenhall and Newgate Markets (by the Carcase).		Best Potatoes per Ton at Waterside Market, Southwark.	
				Beef.	Mutton.		
1862	£.	s. d.					
June 30	93 <sup>6</sup> / <sub>8</sub>	56 8	58,728	136,230	4d.—6d. Mean 5d.	5d.—7d. Mean 6d.	180s.—200s. Mean 190s.
Sept. 30	93 <sup>3</sup> / <sub>8</sub>	56 10	57,592	295,276	4 <sup>1</sup> / <sub>2</sub> d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>1</sup> / <sub>4</sub> d.	5 <sup>1</sup> / <sub>2</sub> d.—7d. Mean 6 <sup>1</sup> / <sub>8</sub> d.	100s.—130s. Mean 115s.
Dec. 31	93 <sup>5</sup> / <sub>8</sub>	48 2	85,522	258,095	4d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	5 <sup>1</sup> / <sub>2</sub> d.—6 <sup>3</sup> / <sub>4</sub> d. Mean 6d.	90s.—110s. Mean 100s.
1863							
Mar. 31	92 <sup>4</sup> / <sub>8</sub>	46 7	75,819	139,429	4d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	5d.—7d. Mean 6d.	120s.—130s. Mean 125s.
June 30	93 <sup>1</sup> / <sub>8</sub>	46 2	82,458	106,633	4 <sup>1</sup> / <sub>2</sub> d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>1</sup> / <sub>4</sub> d.	4 <sup>3</sup> / <sub>4</sub> d.—6 <sup>3</sup> / <sub>4</sub> d. Mean 5 <sup>3</sup> / <sub>4</sub> d.	110s.—130s. Mean 120s.
Sept. 30	93	45 7	73,920	157,582	4 <sup>1</sup> / <sub>2</sub> d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>3</sup> / <sub>8</sub> d.	4 <sup>3</sup> / <sub>4</sub> d.—6 <sup>3</sup> / <sub>4</sub> d. Mean 5 <sup>3</sup> / <sub>4</sub> d.	70s.—105s. Mean 87s. 6d.
Dec. 31	92 <sup>7</sup> / <sub>8</sub>	40 6	113,397	145,823	4d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	5d.—7d. Mean 6d.	60s.—80s. Mean 70s.
1864							
Mar. 31	91	40 4	99,013	138,523	4 <sup>1</sup> / <sub>2</sub> d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>1</sup> / <sub>2</sub> d.	5 <sup>1</sup> / <sub>2</sub> d.—7d. Mean 6 <sup>1</sup> / <sub>4</sub> d.	55s.—70s. Mean 62s. 6d.
June 30	91 <sup>4</sup> / <sub>8</sub>	39 7	92,569	100,102	4 <sup>1</sup> / <sub>2</sub> d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>1</sup> / <sub>4</sub> d.	5 <sup>1</sup> / <sub>2</sub> d.—7d. Mean 6 <sup>1</sup> / <sub>8</sub> d.	40s.—60s. Mean 50s.
Col.	1	2	3	4	5	6	7

\* NOTE.—The total number of quarters of wheat sold in England and Wales for the 13 weeks ending June 30th, 1862, was 763,463; for the 13 weeks ending September 30th, 1862, 748,702; for the 13 weeks ending December 31st, 1862, 1,111,787; for the 13 weeks ending March 31st, 1863, 985,649; for the 13 weeks ending June 30th, 1863, 1,073,126; for the 13 weeks ending September 30th, 1863, 960,956; for the 13 weeks ending December 31st, 1863, 1,474,160; for the 13 weeks ending March 31st, 1864, 1,287,171; and for the 13 weeks ending June 30th, 1864, 1,203,406. The total number of quarters entered for Home Consumption in the same period was respectively, 1,770,998; 3,838,584; 3,355,239; 1,812,585; 1,386,233; 2,048,568; 1,895,705; 1,800,806; and 1,301,323.

STATISTICS  
OF  
THE WEATHER, PUBLIC HEALTH, PRICE OF  
PROVISIONS, &c., &c.,  
FOR THE SIX MONTHS ENDING DECEMBER 31, 1863.

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*Chiefly extracted from the Quarterly Report of the Registrar-General.—  
The Corn Returns and Diagram are prepared from Official Documents  
expressly for this Journal.*

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ON

## THE METEOROLOGY OF ENGLAND

DURING

THE QUARTER ENDING SEPTEMBER 30, 1863.

BY JAMES GLAISHER, Esq., F.R.S.,

SEC. OF THE BRITISH METEOROLOGICAL SOCIETY.

FROM July 1st to 15th, excepting two days, the temperature of the air exceeded the average by  $2\frac{1}{4}^{\circ}$ . This was followed by a cold period extending to August 1st, during which the daily deficiency averaged  $3\frac{3}{4}^{\circ}$ . On July 19th the temperature fell to  $32^{\circ}$  in the air, and much lower on the ground, at most places north of London. A warm period succeeded, and continued till August 16th, the excess of temperature amounting to  $3\frac{1}{2}^{\circ}$ . From the 17th August to the end of September it was cold, the average daily deficiency being  $2\frac{1}{4}^{\circ}$ .

The mean high day temperature of the air was  $\frac{3}{4}^{\circ}$  in excess in July,  $1^{\circ}$  in excess in August, and  $4^{\circ}$  in defect in September, as compared with the averages of the preceding 22 years.

The mean low night temperature of the air was  $3\frac{3}{4}^{\circ}$  in defect in July,  $\frac{1}{2}^{\circ}$  in excess in August, and  $3^{\circ}$  in defect in September.

The mean temperature of the air was  $\frac{3}{4}^{\circ}$  in defect in July,  $\frac{1}{2}^{\circ}$  in excess in August, and  $3\frac{1}{4}^{\circ}$  in defect in September.

The mean temperature of the dew-point was  $2^{\circ}$  in defect in July,  $0^{\circ}5$  in defect in August, and  $4^{\circ}3$  in defect in September. The degree of humidity was below its average value.

The pressure of the atmosphere in each month was slightly in excess in July, and a little below the average in August and September.

The fall of rain in July was 0.9 inch, in August 1.8 inch, and in September 3.2 inches; the total fall for the quarter was 5.9 inches, being 1.6 inch below the average of the preceding 47 years.

The temperature of vegetation as shown by a thermometer placed on grass was below  $30^{\circ}$  on 4 nights, between  $30^{\circ}$  and  $40^{\circ}$  on 26 nights, and above  $40^{\circ}$  on the other 62 nights.

The mean temperature of the air at Greenwich in the three months ending August, constituting the three summer months, was  $60^{\circ}3$ , being  $0^{\circ}2$  above the average of the preceding 92 years.



# ON THE METEOROLOGY OF ENGLAND

DURING

THE QUARTER ENDING DECEMBER 31, 1863.

BY JAMES GLAISHER, Esq., F.R.S.,

SEC. OF THE BRITISH METEOROLOGICAL SOCIETY.

TILL October 9th the weather was alternately warm and cold; on the 10th a warm period set in, continuing to the 22nd, the average daily excess being nearly  $5^{\circ}$ ; thence to November 13th the temperature was variable, the average daily deficiency being rather more than  $1^{\circ}$ . For the remaining 48 days of the quarter the temperature was greatly above the average, the excess amounting to  $4\frac{1}{2}^{\circ}$  daily. The period from October 30th till December 4th was unusually stormy.

The mean high day temperature was about the average in October,  $2^{\circ}$  in excess in November, and  $3^{\circ}4$  in excess in December.

The mean low night temperature was  $2^{\circ}1$  in excess in October,  $2^{\circ}9$  in excess in November, and  $1^{\circ}1$  in excess in December.

The mean temperature of the air was  $1^{\circ}$  in excess in October,  $1^{\circ}75$  in excess in November, and nearly  $3^{\circ}$  in excess in December.

The mean temperature of the dew-point was  $1^{\circ}25$  in excess in October,  $2^{\circ}5$  in excess in November, and  $1^{\circ}5$  in excess in December; the degree of humidity being about its average in October and November, and below in December.

The pressure of the atmosphere was a little below its average in October, and a little above in November and December.

The fall of rain was 1.7 inch in October, 1.8 inch in November, and 1.1 inch in December. The total fall for the quarter was 4.6 inches, being  $2\frac{1}{2}$  inches below the average of the preceding 46 years.

The temperature of vegetation was below  $30^{\circ}$  on 28 nights; between  $30^{\circ}$  and  $40^{\circ}$  on 36 nights; and above  $40^{\circ}$  on 28 nights.

The mean temperature of the air at Greenwich in the three months ending November, constituting the three autumn months, was  $50^{\circ}3$ , being  $0^{\circ}9$  above the average of the preceding 92 years.



## THE WEATHER DURING THE QUARTER ENDING DECEMBER 31, 1863.

1863. MONTHS.	Temperature of						Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.						
	Air.		Evaporation.		Dew Point.		Air—Daily Range.		Mean.		Diff. from average of 22 years.				
	Mean.	Diff. from average of 92 years.	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.			
October ..	51.6	+2.1	49.7	+1.2	47.8	+1.4	12.7	-2.0	333	+0.16	3.7	0.0			
November ..	45.7	+3.3	44.2	+2.6	42.4	+2.6	10.8	-0.9	271	+0.19	3.1	+0.3			
December ..	43.2	+4.2	41.1	+2.3	38.5	+1.4	11.8	+2.3	233	+0.10	2.7	+0.1			
Mean ..	46.8	+3.2	45.0	+2.0	42.9	+1.8	11.8	-0.2	279	+0.15	3.2	+0.1			
1863. MONTHS.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Tempera- ture of Water of the Thames.		Number of Nights it was			Reading of Thermometer on Grass.	
	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.	Amount.	Diff. from average of 46 years.	Mean.	Diff. from average of 46 years.	At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.	Mean.	Diff. from average of 22 years.	Sum	Diff. from average of 46 years.	Mean	Diff. from average of 46 years.	Sum	Sum	Sum	Lowest	Highest
October ..	87	0	29.638	-0.061	537	-2	1.7	-1.1	54.8	-1.1	1	14	16	23.0	50.8
November ..	88	-1	29.870	+0.121	547	-1	1.8	-0.6	48.5	-0.6	11	12	7	17.7	48.8
December ..	83	-6	29.942	+0.126	552	0	1.1	-0.8	44.0	-0.8	16	10	5	16.2	43.0
Mean ..	86	-2	29.817	+0.062	545	-1	4.6	-2.5	49.1	-2.5	28	36	28	16.2	50.8

NOTE.—In reading this table it will be borne in mind that the sign (-) minus signifies below the average, and that the sign (+) plus signifies above the average.

## STATE OF THE PUBLIC HEALTH.

*1st Quarter.*—The total number of deaths in the quarter was 112,384 against 101,232 and 92,225 in the two previous summer quarters. In the same quarter of 1860 it was only 86,312; and if last summer had been as healthy, at least 23,000 persons would have been living when autumn came whose deaths had then been registered. The annual rate of mortality in the quarter was 2·166 per cent. of the population, against the summer average of 1·982 per cent. In the country districts the mortality was 1·864 (the average being 1·694); whilst in urban populations it was 2·404 (the average being 2·329).

*2nd Quarter.*—The number of deaths in the three months ending 31st December was 116,299. The death-rate was 2·226 per cent. (against an average of 2·178). In the principal towns the rate of mortality was 2·46 per cent. (about the average); and in the small towns and country parishes 1·94 per cent. (or rather above the average). 475,582 deaths were registered in the year, the mortality being at the rate of 2·314 per cent. against 2·211, the average of the previous ten years.

## PRICE OF PROVISIONS.

*1st Quarter.*—The average price of wheat was 45s. 7d. per quarter, which is less than at any other time since March, 1860; in the September quarter of last year the price was 56s. 10d. The average of the highest and lowest prices of beef at Leadenhall and Newgate Markets was 5 $\frac{3}{8}$ d. per lb., and of mutton 5 $\frac{3}{4}$ d. Best potatoes ranged from 70s. to 105s. per ton at the Waterside Market, Southwark; they were cheaper than they had been at the same place at any previous time since the same quarter of 1859.

*2nd Quarter.*—The average price of wheat in the three months was 40s. 6d. per quarter, which is less by 18s. 9d. than in the corresponding period of 1861, and less by 7s. 8d. than in that of 1862. The average price of beef at Leadenhall and Newgate Markets was 5 $\frac{1}{4}$ d. per lb., mutton 6d.; both being the same as in the corresponding quarter of 1862. The average price of the best potatoes at the Waterside Market was 70s. per ton, which is less by 30s. than it was in the last quarter of the previous year.

## THE PRICE OF PROVISIONS.

The AVERAGE PRICES of Consols, of Wheat, Meat, and Potatoes; also the AVERAGE QUANTITY of Wheat sold and imported weekly, in each of the Nine Quarters ending December 31, 1863.

Quarters ending	Average Price of Consols (for Money).	Average Price of Wheat per Quarter in England and Wales.	Wheat sold in the 290 Cities and Towns in England and Wales making Returns.*	Wheat and Wheat Flour entered for Home Consumption at Chief Ports of Great Britain.*	Average Prices of		
					Meat per lb. at Leadenhall and Newgate Markets (by the Carcase).		Best Potatoes per Ton at Waterside Market, Southwark.
		Average number of Quarters weekly.	Beef.	Mutton.			
1861 Dec. 31	£. 93 <sup>2</sup> / <sub>8</sub>	5s. d. 59 3	112,809	121,480	4d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	4 <sup>3</sup> / <sub>4</sub> d.—6 <sup>3</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>2</sub> d.	110s.—130s. Mean 120s.
1862 Mar. 31	93 <sup>1</sup> / <sub>8</sub>	60 1	74,163	132,882	4d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	4 <sup>3</sup> / <sub>4</sub> d.—6 <sup>1</sup> / <sub>2</sub> d. Mean 5 <sup>3</sup> / <sub>8</sub> d.	130s.—155s. Mean 142s.6d.
June 30	93 <sup>6</sup> / <sub>8</sub>	56 8	58,728	136,230	4d.—6d. Mean 5d.	5d.—7d. Mean 6d.	180s.—200s. Mean 190s.
Sept. 30	93 <sup>2</sup> / <sub>8</sub>	56 10	57,592	295,276	4 <sup>1</sup> / <sub>4</sub> d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>4</sub> d.	5 <sup>1</sup> / <sub>4</sub> d.—7d. Mean 6 <sup>1</sup> / <sub>8</sub> d.	100s.—130s. Mean 115s.
Dec. 31	93 <sup>5</sup> / <sub>8</sub>	48 2	85,522	258,095	4d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	5 <sup>1</sup> / <sub>4</sub> d.—6 <sup>3</sup> / <sub>4</sub> d. Mean 6d.	90s.—110s. Mean 100s.
1863 Mar. 31	92 <sup>4</sup> / <sub>8</sub>	46 7	75,819	139,429	4d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	5d.—7d. Mean 6d.	120s.—130s. Mean 125s.
June 30	93 <sup>1</sup> / <sub>8</sub>	46 2	82,458	106,633	4 <sup>1</sup> / <sub>4</sub> d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>4</sub> d.	4 <sup>3</sup> / <sub>4</sub> d.—6 <sup>3</sup> / <sub>4</sub> d. Mean 5 <sup>3</sup> / <sub>4</sub> d.	110s.—130s. Mean 120s.
Sept. 30	93	45 7	73,920	157,582	4 <sup>1</sup> / <sub>2</sub> d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>3</sup> / <sub>8</sub> d.	4 <sup>3</sup> / <sub>4</sub> d.—6 <sup>3</sup> / <sub>4</sub> d. Mean 5 <sup>3</sup> / <sub>4</sub> d.	70s.—105s. Mean 87s.6d.
Dec. 31	92 <sup>7</sup> / <sub>8</sub>	40 6	113,397	145,823	4d.—6 <sup>1</sup> / <sub>4</sub> d. Mean 5 <sup>1</sup> / <sub>8</sub> d.	5d.—7d. Mean 6d.	60s.—80s. Mean 70s.
Col.	1	2	3	4	5	6	7

\* NOTE.—The total number of quarters of wheat sold in England and Wales for the 13 weeks ending December 31st, 1861, was 1,466,525; for the 13 weeks ending March 31st, 1862, 964,121; for the 13 weeks ending June 30th, 1862, 763,463; for the 13 weeks ending September 30th, 1862, 748,702; for the 13 weeks ending December 31st, 1862, 1,111,787; for the 13 weeks ending March 31st, 1863, 985,649; for the 13 weeks ending June 30th, 1863, 1,073,126; for the 13 weeks ending September 30th, 1863, 960,956; and for the 13 weeks ending December 31st, 1863, 1,474,160. The total number of quarters entered for Home Consumption was respectively, 1,579,241; 1,727,464; 1,770,998; 3,838,584; 3,355,239; 1,812,585; 1,386,233; 2,048,568; and 1,895,705.



# JOURNAL

OF THE

## ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

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### I.—*Agricultural Progress and the Royal Agricultural Society.*

By H. S. THOMPSON, M.P.

THE Royal Agricultural Society was formed in 1838, and inscribed on the title-page of its Journal the significant motto "*Practice with Science.*" The present volume will end the first series of that publication, and the occasion seems a fitting one for reviewing and registering the results which Practice, aided by Science, has been able to accomplish during the intervening quarter of a century.

The period in question has been remarkable for several events, each of which has left its distinctive mark upon British agriculture, and any attempt to chronicle the progress of agricultural improvement since 1838 would be incomplete and even deceptive if it did not point out the important consequences resulting from the adoption of free trade, the rise and progress of the railway system, and the application of steam power to the operations of husbandry.

Before entering on these and other important questions connected with the subject before us, it will be proper to give a brief account of the progress and present position of the Royal Agricultural Society itself.

*Commencement and Progress of the Royal Agricultural Society.*—The commencement of the Society took place during one of those recurring fits of associative activity to which Englishmen are periodically prone. The Yorkshire Agricultural Society (for many years our largest provincial Agricultural Society, with a prize-list of 800*l.* to 1000*l.* per annum) was formed in 1837; the Royal Agricultural Society in 1838; the Royal Irish Improvement Society in 1841. The formation of these and numerous other local societies within a very brief period, and on an unusually extended scale both as to numbers and resources, was, in fact, the application to agriculture of the same tendency to organise companies which was so strongly developed about that time, and



culminated in the railway mania of 1845-46. Fortunately for agriculture, there were no premiums to be realized by joining these societies, so that they were not pushed beyond their legitimate limits, and have been productive of unmixed benefit.

Agricultural societies had been tried at a much earlier date. "The Bath Society for the encouragement of Agriculture, Arts, Manufactures, and Commerce within the Counties of Somerset, Wilts, Gloucester, and Dorset, and the City and County of Bristol," was formed in 1777. This society claims to be the earliest agricultural society founded in Great Britain. The Highland Society (Scotland) was constituted in 1784, and received a Royal Charter in 1787. The Charter of the English Board of Agriculture is dated August 23, 1793. These and other minor societies have doubtless been productive of much benefit in their respective localities, and can boast of the names of many patriotic and eminent men who enlisted in their ranks; but the times were not favourable for the development of such institutions, and all of them fell far short of the dimensions and wide-spread usefulness attained by the later societies, and by some of the older institutions themselves when reorganised at a later date.

The cause of this is obvious. So long as agricultural societies had *fixed places of meeting*, and the stock and implements intended for exhibition were conveyed over the *ordinary roads*, they drew their supplies from such limited areas, that their showyards were very indifferently furnished, and were only attractive to the residents in their immediate neighbourhood. From the paucity of their visitors the receipts were small, and their funds consequently insufficient to admit of their offering such prizes as would tempt more distant owners of stock to face the cost and risk of lengthened travel. The societies were thus compelled to trust more to donations and subscriptions than to the popularity of their shows as their chief source of revenue. Energetic managers and liberal patrons may for a time supply the place of more general support; but when the zeal or the strength of a few public-spirited individuals fails, societies, so supported, are either given up or fall into a state of chronic inaction, and it would be easy to prove from the annals of these early days that in order to be permanently useful all such societies must be self-supporting. Even the Board of Agriculture, with its perpetual Charter and Parliamentary grant, formed no exception to this rule; and notwithstanding the talent and energy with which for a time its operations were conducted, and the prestige attaching to the honoured names of its president, Sir J. Sinclair, and its secretary, Arthur Young, on the extinction of its Parliamentary grant in 1819, the Board was reduced to the last stage of exhaustion, and died a natural death shortly after.



At the time of the renaissance of these societies the migratory principle was generally adopted. The Highland Society, which was reorganized in 1834 under the more extended title of "The Highland and Agricultural Society of Scotland," was probably the first to adopt this system, which was followed by the Yorkshire Society in 1837, by the Royal Agricultural Society in 1838, and subsequently by the Royal Irish Improvement Society, and some few of the leading provincial associations. The importance of not visiting the same district twice, except at an interval of some years, can scarcely be overrated, as by this means new exhibitors, new visitors, and new contributors to the expenses of the meetings are annually secured, and it is notorious that a life and activity have thus been infused into these meetings, of which previously they were in great need.

Second only in importance to the migratory principle has been the rapid extension of the railway system, by which stock, implements, and visitors have been conveyed to these shows in much less time and at much smaller cost, and therefore from much greater distances and in much larger numbers. The increased receipts thus obtained for admission to the showyards have furnished means for the offer of larger prizes, and thus increased the attractions of subsequent exhibitions, so that the improved mode of conveyance afforded by railways, and the improved policy of changing the places of meeting, have during the last twenty-five years fostered and developed these associations to an unprecedented extent, the published list for the present year containing the names of no less than 358 agricultural societies in Great Britain and Ireland.

The circumstances which favoured the formation of the Royal Agricultural Society having been thus briefly described, its progress will be best perceived by inspecting the accompanying statistical tables, which give the leading facts of its history in a compendious form.

*Statistics of the Royal Agricultural Society.*—Table (A.) shows the number of its members and its annual income and expenditure (irrespective of the country meetings), commencing with 1841, the first year in which the Society's balance-sheet and list of members were sufficiently complete to be of any value in a comparative point of view. Some explanatory remarks are, however, required to prevent misconceptions.

In column 2 will be found the number of members on the Society's books in each year at the time of the annual meeting in May. These figures give an average of 5522 for the whole period. A considerable deduction must, however, be made on account of those members who allowed their names to remain on

the books, but who refused to pay their subscriptions when in arrear, on the ground that they had ceased to be members of the society. During the earlier portion of the period under consideration the necessity for prompt measures in such cases was not fully recognised; but in December, 1845, the arrears having reached the large amount of 6726*l.*, it became necessary to take decisive steps, and in the following year the names of 789 members were struck out of the Society's books. The necessity that had thus arisen for purging the list of the names of those whose membership was only nominal, will explain the apparently large falling off in the Society's numbers which took place in 1847 and on one or two subsequent occasions. After making these deductions, it will be found that the Society's list of *subscribers* has varied but little during this long period, and that the average number has been about 5000.

Column 3 shows the receipts from annual subscriptions and the compositions paid by life members. The explanation given of the figures in column 2 will also account for great fluctuation in the amounts received under this head. In 1860, for example, no less than 2165*l.* of arrears were paid up. Without this explanation it would be strange indeed to find that the subscriptions received this year more than doubled those of 1859, though the number of members had varied but little. In order, therefore, to form a fair estimate of the Society's income, it becomes necessary to take an average of the whole period, which shows an annual revenue from this source of 5491*l.*

The only other source of permanent income consists of the dividends on the investments which the Society has been able to make from time to time in government securities. These dividends appear in column 4, and, adding the figures in this to those in the preceding column, we arrive at the totals in column 5, which show that the society has possessed an average gross income of 5800*l.* per annum.

Turning now to the expenditure side, we find in column 6 that the whole cost of management has been defrayed for 1735*l.* per annum, including the repair and maintenance of the house in Hanover-square, also rates, taxes, salaries, office charges, and sundries.

The net cost of the Journal is given in column 7. This is made up of the charges for paper, printing, and advertising, payments for prize essays and literary contributions, including the editor's salary, but deducting the proceeds of the sale of the Journal. It is satisfactory to find that the average charge on account of the Journal for the last ten years has been less than the average annual cost during the preceding ten, notwithstanding the additional payments for editorship during

TABLE A.

Year.	Number of Members.	RECEIPTS.			EXPENDITURE.			
		Subscriptions. — Including Compositions of Life Members.	Dividends on Stock.	TOTAL.	Management.	Journal.	Chemical and Veterinary Grants.	TOTAL.
1.	2.	3.	4.	5.	6.	7.	8.	9.
		£.	£.	£.	£.	£.	£.	£.
1841	4,595	5,818	200	6,018	1,882	1,611	..	3,493
1842	5,834	5,884	214	6,098	2,087	1,543	..	3,630
1843	7,000	6,628	245	6,873	2,742	1,242	..	3,984
1844	6,927	7,117	320	7,437	1,826	2,095	..	3,921
1845	6,933	6,342	251	6,593	1,791	1,611	..	3,402
1846	6,971	7,040	221	7,261	2,052	2,891	120	5,063
1847	6,391	6,365	271	6,636	1,676	2,126	310	4,112
1848	6,335	5,211	312	5,523	1,635	1,765	430	3,830
1849	5,512	6,372	280	6,652	1,622	2,059	450	4,131
1850	5,261	6,083	321	6,404	1,605	1,976	413	3,994
1851	5,121	5,953	321	6,274	1,349	1,715	600	3,664
1852	4,981	5,244	334	5,578	1,482	1,710	700	3,892
1853	4,923	4,801	327	5,128	1,402	1,794	826	4,022
1854	5,177	5,053	335	5,388	1,429	1,327	606	3,362
1855	4,882	3,449	261	3,710	1,763	1,224	691	3,678
1856	4,979	5,156	259	5,415	1,962	976	600	3,538
1857	5,068	3,728	265	3,993	2,115	1,119	817	4,051
1858	5,146	5,339	282	5,621	1,699	1,563	472	3,734
1859	5,161	3,027	289	3,316	1,255	1,586	625	3,466
1860	5,165	6,398	319	6,717	1,592	1,610	675	3,877
1861	4,633	4,789	425	5,214	1,537	1,723	921	4,181
1862	4,823	5,463	505	5,968	1,949	2,139	953	5,041
1863	5,183	5,050	478	5,528	1,459	1,806	695	3,960

Column 8 shows the amount annually voted for chemical and veterinary investigations and lectures. These amounts were exceptionally large in 1861 and 1862, in consequence of special investigations ordered by the Council on *Cheesemaking* and the *Rot in Sheep*. The average amount devoted to these departments of science during the last fourteen years has been 685*l.* per annum.

The general result of the 23 Country Meetings here tabulated cannot be considered otherwise than satisfactory; for, though their whole cost, exclusive of prizes, has been 134,616*l.* (column 4), the receipts, on the other hand, have exceeded that amount by 7577*l.*; so that the Society has not drawn on its funds to defray any part of the cost of the Annual Shows except the amount awarded by them in prizes; and towards meeting this charge the above-mentioned balance of 7577*l.* has been received, leaving the net sum to be provided by the Society 33,078*l.*, or 1433*l.* per annum.

	£.
For the 7 years 1841 to 1847 having been .. ..	4140
" " 1848 " 1854 " .. ..	5009
For the last 7 years (excluding Battersea) .. ..	8565



TABLE B.—COUNTRY MEETINGS.

Year.	Place.	Prizes.	Expenditure exclusive of Prizes.	Total Expenditure.	Total Receipts.	Receipts in excess of Expen- diture.	Expen- diture in excess of Receipts.
1.	2.	3.	4.	5.	6.	7.	8.
		£.	£.	£.	£.	£.	£.
1841	Liverpool	1,220	5,052	6,272	4,106	..	2,166
1842	Bristol ..	1,233	4,775	6,008	4,202	..	1,806
1843	Derby .. ..	1,463	5,091	6,554	3,390	..	3,164
1844	Southampton	1,335	5,736	7,071	4,929	..	2,142
1845	Shrewsbury	1,259	5,406	6,665	3,670	..	2,995
1846	Newcastle	1,391	4,866	6,257	4,119	..	2,138
1847	Northampton	1,338	4,863	6,201	4,565	..	1,636
1848	York .. ..	1,700	5,957	7,657	4,831	..	2,826
1849	Norwich ..	1,951	4,352	6,303	4,345	..	1,958
1850	Exeter ..	1,725	4,845	6,570	4,941	..	1,629
1851	Windsor ..	1,870	5,032	6,902	5,608	..	1,294
1852	Lewes ..	1,637	5,066	6,703	3,485	..	3-218
1853	Gloucester	1,666	5,910	7,576	5,493	..	2,083
1854	Lincoln ..	1,510	5,856	7,366	6,364	..	1,002
1855	Carlisle ..	1,526	5,363	6,889	6,029	..	860
1856	Chelmsford	1,600	5,728	7,328	5,346	..	1,982
1857	Salisbury ..	1,595	4,893	6,488	6,142	..	346
1858	Chester ..	2,156	6,975	9,131	10,312	1,181	..
1859	Warwick ..	1,689	5,779	7,468	8,902	1,434	..
1860	Canterbury	1,942	5,943	7,885	5,879	..	2,006
1861	Leeds .. ..	2,317	6,754	9,071	13,542	4,471	..
1862	Battersea ..	3,980	11,814	15,794	12,160	..	3,634
1863	Worcester	2,552	8,560	11,112	9,833	..	1,279
		40,655	134,616	175,271	142,193	7,086	40,164

The foregoing account of the Society's affairs shows that during the last twenty-three years it has received the steady personal support of 5000 of the leading agriculturists of the kingdom, and that, including the Country Meetings, the total receipts have been 12,000*l.*, and the total expenditure 11,500*l.* per annum, the balance having been invested as a guarantee fund to meet any temporary emergency.

On a review of the whole period, the Council may, therefore, fairly claim—1st, That the result of their management has been to place the finances of the Society on a sound and satisfactory basis; and 2ndly, That when tested by the results of their annual Exhibitions of Stock and Implements, the course pursued by the Society is shown to have secured *increasing popularity and steady progress.*

*Improvement of Agricultural Machinery.*—Having thus far confined our attention to the position of the Royal Agricultural Society itself, we proceed to trace its connexion with the rapid development of British agriculture, which is so evident to everyone connected with rural pursuits, and yet is so difficult to measure or state in definite terms. The first branch of this inquiry which claims our attention is that of Agricultural Mechanics. It is this department which has made the most rapid advance since 1838; and many of the most striking of the recent improvements in British husbandry would have been impossible without the number of new inventions and the more skilled manufacture of all farming implements which have characterized the period in question. In order properly to appreciate the extent of the change which has taken place in farm machinery, it will be necessary to recall the position occupied by this department twenty-five years ago. In 1837, the writer of this article took an active share in the meetings which were held with a view to the formation of the Yorkshire Agricultural Society. These meetings were attended by the late Lord Spencer and a number of the leading agriculturists of Yorkshire from all the three Ridings. The principles on which the Society should be conducted underwent the most thorough consideration and discussion, and the first prize-sheet may be taken to represent the deliberate estimate formed by the best Yorkshire farmers of that day of the relative importance of *Stock* and *Implements.*

The following were the amounts offered as prizes at that Society's first Meeting at York in 1838:—*Stock*, 424*l.*; Specimens of *Wool, Roots, and Seeds*, 65*l.*; *Essays and Reports*, 80*l.*; *Implements*, 30*l.* So that out of a total of 600*l.*, 30*l.*, or 5 per cent., was thought sufficient to give "For the invention and



improvement of such Agricultural Implements as may appear to the Committee to deserve reward."

In the following year (1839), the Royal Agricultural Society held its first Meeting at Oxford. The prizes offered were apportioned as follows:—Stock, 740*l.*; Seed-wheat, 100*l.*; Essays, 135*l.*; whilst the amount offered for Implements (with the exception of special prizes for a draining-plough and a gorse-crusher, neither of which were competed for) was confined to the announcement, "For any new Agricultural Implement such sum as the Society may think proper to award;" and a contingent interest in the sum of 50*l.* offered for *Extra Stock, Implements, Roots, and Seeds*. The value of these rather problematical offers was ascertained at the time of the Show, when the Judges awarded *Five pounds* to the prize implements, *with one Gold and three Silver Medals*. Estimating these medals at their cost to the Society, about *one and a half per cent.* of the money given away at Oxford was awarded to the Implement Department!

At the Society's Cambridge Meeting in 1840, above 1000*l.* was offered in prizes, but the *Implements* rather lost than gained ground, the special prize of 50*l.* for a draining-plough having been withdrawn, whilst the other prizes for Implements remained as in the Oxford prize-sheet. *No money and only seven medals* were awarded to the Implements at the Cambridge Meeting!

The subordinate position occupied by Agricultural Machinery at the time of these Meetings is thus sufficiently evident; but a striking corroboration of the fact is to be found in the first Essay read before the Society (March 13th, 1839) by that accomplished writer the late Mr. Pusey. The title of the paper was, 'On the Present State of the Science of Agriculture in England,' and no one was more capable than Mr. Pusey of justly estimating the relative importance (according to the ideas of the day) of the numerous subjects discussed in that valuable and exhaustive article.\* It is curious to find that the only implements there alluded to were the plough and the harrow, the turnip-slicer and the thrashing-machine, with the exception of the following paragraph on the drill, which sounds so strange in the ears of a farmer of the present day that it seems barely credible that it should have been penned by one so thoroughly conversant with his subject at so late a date as 1839. "*The use of another instrument, the drill-machine, a more complicated one, by which the seed is laid in regular rows, has lately become frequent in Southern as well as in Northern England; though it has established itself so slowly, that for a long time travelling machines of this kind have made yearly journeys from Suffolk as far as*

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\* 'Journal,' vol. i. p. 1.

*Oxfordshire, for the use of those distant farmers by whom their services are required."* Volumes of proof of the complete revolution which has taken place in farming implements since 1839 would not be more convincing than the simple announcement that Mr. Pusey, in his inaugural address to the members of the Royal Agricultural Society, thought it necessary to inform them that the drill was a machine by which *the seed was laid in regular rows*; or than the surprising fact which he records that Suffolk drills have actually perambulated the half of England since the accession, *not of good Queen Bess, but of her Gracious Majesty Queen Victoria!*

The insignificant position allotted to farming implements little more than twenty years ago having now been sufficiently shown, a few short extracts from the records of the Society will prove the extent of the advance which has subsequently taken place.

At the *Oxford* meeting the portion of the catalogue devoted to implements contained the names of *twenty exhibitors*, and occupied *less than one page octavo!*

At *Cambridge* there were thirty-two exhibitors, and the description of the implements occupied a page and a half of the catalogue. Yet the *Cambridge* show of implements was in 1840 considered a great success, and the report (which bore the signature of three most competent judges and expressed the general opinion of those present), stated that "*beyond controversy, such a selection of implements was never before collected in one showyard.*"

The Society's last show was held at *Worcester*, and there were assembled 282 exhibitors of implements, who showed 5839 articles (excluding duplicates), and the catalogue describing them formed a thick octavo volume of 457 pages. There were 135 *steam-engines*, 11 *traction ditto*, 12 *steam-ploughs*, 29 *steam-cultivators*, 57 *steam thrashing-machines*, and 45 *reaping and mowing-machines*. These articles have been selected as most illustrative of progress, and their bare enumeration would have been sufficient if the object of the writer had been simply to furnish some statistical proof of the recent development of agricultural mechanics in this country. Unfortunately, however, there exists a fundamental difference of opinion between the managers of the Society and several of the leading implement-makers respecting the proper mode of conducting shows of implements; and, when recording the great success of the *Worcester Exhibition*, the occasion seems a suitable one for considering this question. The benefits conferred upon agriculture by the talent and enterprise of the makers of implements have been so great that no pains should be spared in the attempt to reconcile these conflicting views; or, should that prove impossible, it is at all events desirable to devote a brief space to a careful statement of the

reasons which have always been considered conclusive against adopting the change of system which they advocate.

The controversy is not new. Several years have elapsed since a few of the leading firms first objected to the prize system, and a sort of crisis took place at the Canterbury meeting in 1860; but as the object of the present remarks is not to put any one in the wrong for what is past, but for the sake of the future clearly to ascertain which view is right, no note of triumph shall be sounded on account of the result of that trial of strength, and the arguments *pro* and *con* shall be as fairly considered as if no differences had ever arisen on the subject.

*The Prize System.*—The fullest and best statement that has yet been made of the views of the implement-makers is contained in a paper by Mr. J. C. Morton, on the Helps and Hindrances to Agricultural Progress, read at the Society of Arts on the 9th of December last. That gentleman has brought to the consideration of this question the extensive information and thorough impartiality for which he is distinguished, and throughout his remarks it is apparent that he is actuated by no carping or fault-finding spirit, but by a *bonâ fide* wish that these important exhibitions should attain their maximum of efficiency. His arguments are therefore entitled to the most careful consideration, and in dealing with them it is satisfactory to feel that we have the whole case before us.

It must be premised that the *prize system* which is called in question is the system of subjecting all implements exhibited to actual trial, in order to award prizes to those which acquit themselves the best; the alternative being that the implements should be *inspected* but not brought into *competition* with others of their own class in such a way as to enable the judges to pronounce any opinion on their *comparative* merit. Mr. Morton contends that the trials are inadequate, partly because the land in July is not in a fit state for the purpose, partly because sufficient time is not allowed the judges for forming their decisions. He further argues that “the award of a prize confers too great *i. e.* too abrupt a distinction” between the winning implement and others whose performances are almost equally good.

The argument founded on the state of the land is not entitled to much weight. Having attended seventeen of the Society’s country meetings, we have sufficient experience of the weather on such occasions to assert that though the trials are sometimes interrupted by wet, and sometimes rendered difficult by drought,—yet that, taking into account temperature and length of day, as well as the state of the land, no month is, on the average, so well fitted as July for carrying out these trials; and that, unless the

drought or the wet be excessive, it is desirable to have a variety of weather, as it gives the opportunity at one time of rewarding an implement which makes good work on hard dry land, and on another occasion one which is not stopped by a few showers of rain. Decisions arrived at under alternations of drought and wet can be commended with all the more confidence to practical farmers, with whom weather difficulties are the ordinary conditions of every-day life.

The second objection, founded on the shortness of the time, is a more grave one. It may be readily conceded that when a class is under trial in which the entries are numerous and where several possess nearly equal merit, it is difficult to test each one so thoroughly as to give the judges perfect confidence in the correctness of their awards. It will also occasionally happen in bad weather or at the close of a hard day's work that trials are more hurried than is desirable. But whilst freely admitting that trials of implements are not *perfect* or *infallible*, we entirely deny that this is sufficient reason for giving them up. The question is not, Do the judges ever make a mistake? but, Are they not right in a large majority of instances? and that this is the case is sufficiently proven by the constantly increasing number of those who are guided in their purchases by the judges' decisions.

The third objection is of a totally different character: it is grounded on what Mr. Morton calls the "excessive character of the prize system." To use his own words, "the prizeman wins, the rest are nowhere." Here again it must be admitted that it not unfrequently happens that two implements are so equal in their performances as to make it difficult to decide between them; yet one only receives the prize for that season. This is an undoubted hardship to the maker of the losing implement, though frequently much mitigated by the award of a medal or special commendation by the judges. It is also true that when implements are nearly equal, the maker who has the cleverest ploughman or drillman will probably win. The state of the ground, too, may on some particular occasion give the preference to an implement which in an average season would have been beaten by one or more of its now distanced competitors. These are the inevitable drawbacks to any competitive system. Precisely the same difficulties occur in horse-racing. Two horses run neck and neck for the Derby; but, on passing the judge's stand, one jockey is strong enough or clever enough to lift his horse bodily and wins by a nose. No one remembers that the second horse ran the race in precisely the same time as the first; but the three inches won by the jockey bring thousands to the fortunate owner, and hand down the horse's name to posterity as a Derby winner. Again,



the course is unusually hard or deep, and the best horse is passed by one which he has beaten before and will beat again under any ordinary circumstances. Yet, notwithstanding these extreme cases, no one denies that, as a general rule, the best horse wins the race, and, above all, no one suggests that *examination by competent judges* would be a satisfactory mode of ascertaining the speed and bottom of a race-horse.

The mistake, as it appears to us, which is committed by the opponents of the prize system, is that they fix their attention too exclusively on the defects and shortcomings from which no system is free, and thus lose sight of the sterling advantages which belong to it, and which have been so long enjoyed that they are taken as a matter of course. For instance, Mr. Morton quotes an instance from the Warwick meeting, where a new man appeared as ploughwright and took many of the principal prizes. This he considers unjust to other makers, whose ploughs made nearly as good work. He adds, that it would not make a difference of one penny an acre whether the prize plough (Messrs. Hornsby's) or Messrs. Howard's or Ransome's were adopted as the implement of the farm. This is probably true; but if there had been no competitive trials, how would it have been known that a few of the leading makers' ploughs were so equal that they might be used indifferently? Would not buyers of implements, instead of confining their attention to those which at Warwick and other shows had won the Society's prizes, have been just as likely to have bought the rubbish which year after year has been steadily eliminated from the sterling implements? Had there been no distinctive marks of ascertained merit, many a worthless implement would by the help of red and blue paint have made a brave show, and, if puffed by a plausible salesman, would for a season or two have sold as well as the best, until disappointed buyers found that they could place no dependence on the machines exhibited, and *the Society's shows would have justly forfeited their prestige, because they had previously lost their usefulness.*

What was the case at the Cambridge meeting which was held before the prize system could be said to have commenced? The great feature of the implement-yard was what would be termed in Kensington English Messrs. Ransome's *Trophy*. How was it described in the report of that meeting? "A bank of their ploughs (eighty-six varieties) were arranged and elevated on planks to the height of at least 20 feet, and struck the eye of the beholder as he entered the yard." We can give the actual experience of a would-be buyer on this occasion, who was at once attracted to Messrs. Ransome's stand, but found himself utterly puzzled by the eighty-six varieties above named. There were no prize-cards or medals of

the Society to guide his judgment, and he felt himself so entirely in the hands of the salesman in attendance, that he made no purchase at all. In this case he would no doubt have been quite safe in Messrs. Ransome's hands; but had the Society adopted the "*Trophy*" instead of the "*Trial*" system, the competition between rival makers, which has caused such persevering efforts to be made for the production of winning implements, would have been equally active in getting up imposing displays of well-grouped machines; and it requires no great effort of imagination to realize the utter bewilderment of a practical farmer attending the Leeds or Worcester show to select and order implements, walking down mile after mile of the sheds (as they would have been), all filled with equally imposing-looking wares, and hearing each in succession described by stentorian lungs as the *best*, the *newest*, the *only* implements worthy of a moment's notice.

We shall be told that in some few instances (the Bath and West of England Society is quoted by Mr. Morton) the competitive system has been abandoned without any injurious consequences. The management of that Society is in very able hands, and if they continue their present system it will be because they find it answer; but if not only the Bath and West of England, but all the local societies in Great Britain, abandoned the competitive system, it would not affect the argument in the smallest degree. As long as the *National Agricultural Society* continues periodically to devote its funds and its energies to an efficient trial of all agricultural machines which seek distinction, so long will the *failures* find it as impossible to obtain purchasers in the showyard of the Bath and West of England Society as in that of the *Royal Agricultural Society* itself, and so long also will the *prize-winners* be regarded with attention at every agricultural meeting in the kingdom.

Mr. Morton mentions that there have been instances where the bestowal of prizes or the suggestions of the *Royal Agricultural Society's* judges have been positively injurious to the efficiency of certain implements, and consequently to the trade of their makers. We shall not for a moment question the accuracy of this statement, nor is there any antecedent improbability in the supposition that out of the many thousand decisions and opinions which have been given by judges at the Society's various meetings, some may have been erroneous, and some useful suggestions may have been so badly carried out in practice as to have resulted in failure; but the general tenor of the communications made by implement-makers to the stewards and judges has been so completely of an opposite character—so many exhibitors have been grateful for hints, and have attributed more or less of their com-



mercial success to the instruction and corrections received in the Society's showyard—that we cannot but consider the cases mentioned by Mr. Morton as altogether exceptional.

Many of the leading manufacturers are undoubtedly opposed to the continuance of competitive trials, and their view of the subject is, we believe, somewhat of the following kind. They have devoted their time, talents, and capital to the improvement of agricultural machinery. They have been eminently successful, and they think that having arrived at this pitch of excellence, they might be trusted to furnish sterling articles in future without being put to the trouble and expense of constantly fighting to maintain their position, with the additional mortification of being occasionally beaten by an implement which they honestly believe to be inferior to their own. With these feelings they are naturally disposed to be hypercritical with regard to the Society's trials, and to magnify unduly every little error or mistake.

Taking a broad view of the question as it affects the implement-makers: what do we find to be the result of three-and-twenty years' experience? Are the firms of old standing continually driven out of the trade by new men? Quite the reverse. No doubt many new men have taken up the business, and some few, like Messrs. Clayton and Shuttleworth and Messrs. Fowler, have in a comparatively short time taken their place among the very first. But it is equally true that the repeated decisions of so many different judges have made more and more clear the indisputable fact that amongst the *most improved* and *best-manufactured* implements in the various classes are always to be found those of the original leaders in this department, Messrs. Garrett, Hornsby, Howard, Ransome, &c. &c. *Can these gentlemen then be serious in maintaining that the trials are so hurried and inadequate as to be unworthy of the confidence of the public?* We feel persuaded that on reconsideration they will lean rather to the more general opinion that on the whole these decisions are not far wrong.

But though the old-established firms have been able to hold their own against all legitimate competition, it is by no means equally clear that in the absence of trials they would be successful in protecting their business from the inroads of plausible charlatans, who are only kept in the background at present by the impossibility of their winning prizes. By abolishing competitive trials the outsiders would have a clear course, and the usual results would probably follow the tempting announcement of *the best quality of work and materials at half the usual prices.*

It thus appears that the prize system is not without compensation to the implement-makers for some unavoidable annoyances, but if the question be treated solely with a view to the interests

of the farmer the case is still more clear. The advocates for the abolition of the trials of the Royal Agricultural Society, mean of course that the precedent should be followed by all local agricultural societies, otherwise it would simply amount to a proposal that the National Society should abdicate its functions in favour of lesser local societies, who would with inferior means have to grapple with a difficulty which by the hypothesis is beyond the strength of the strongest. We will suppose therefore that competitive trials were generally abandoned. For a year or two, perhaps more, the want would not be greatly felt. *The marks of the prize system would not have worn out*, but after a time, new wants and new inventions would have brought into the field a new generation of implements, and as there would be no opportunity of comparing the efficiency of the productions of the whole country and conferring on the winners a national reputation, the natural tendency to patronise neighbouring and local makers would resume its sway. Certain implements would become famous in particular districts, and if the intelligence of the age would allow of so long a suspension of what would soon be perceived to be a national requirement, we should at length relapse into a similar state to that which existed in 1839, when the plough of Yorkshire was a totally different implement from the plough of Kent, and the Suffolk drill was only a visitor in the counties of Berkshire and Oxfordshire.

It is important when considering this question to keep prominently before us the main object of Implement Shows, and the following sentences extracted from the Reports of the Society's Exhibitions of Implements in 1848 and 1849 are quite in point:—

“The principal advantages to be derived from Shows of Implements may be classed under three heads, of which the first and most important is, that the awards of prizes should point out to every farmer who enters the Show-yard the best implements in their respective classes which the kingdom produces. Farmers, as a body, have neither the means nor the leisure required for travelling about to visit the manufactories of the various implement-makers; nor, if this were practicable, could they safely decide on the comparative efficiency of their respective productions by merely seeing them in the makers' yards. It is, therefore, a great advantage to the farmers of any district to have a large show of implements brought into their neighbourhood, especially when the best of each class are pointed out to them by competent judges after a fair trial.”\* . . . .

“The attention of some of the leading members of the Society

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\* ‘Journal,’ vol. ix. p. 378.

(especially of the late lamented Mr. Handley) was earnestly directed to the improvement of this department, and they soon perceived that little was gained by collecting implements in a Show-yard for people to gaze at, unless an adequate trial could be made of their respective merits. To attain this end great exertions were made, and every improvement in the mode of trial was followed by so marked an increase in the number and merit of the implements brought forward at subsequent shows, as to prove the strongest incentive to further effort. . . . The additional amount offered in prizes at the later meetings has undoubtedly assisted in creating this great increase of competition, but it cannot be considered the principal cause, since the implement-makers are unanimous in declaring that, even when most successful, the prizes they receive do not reimburse them for their expenses and loss of time. How, then, are the increased exertions of the machine-makers to be accounted for? Simply by the fact that the trials of implements have gradually won the confidence of the farmer, so that, when selecting implements for purchase, he gives the preference to those which have received the Society's mark of approval. . . .

"It thus appears that concurrently with the extension and improvement of the trials a corresponding increase and improvement has taken place in the exhibitions of implements; and though it is difficult to *prove* that the one has been the cause of the other, still the probability that such is the case almost amounts to certainty, when it is found that classes of implements which are so faulty in construction as to be strongly animadverted on by the Judges at one meeting, are at the next nearly free from those defects which had been previously pointed out. . . . If the foregoing reasoning be correct (and the facts on which it is founded will not admit of question), the Society may fairly claim to have been, in great measure, the authors of the very rapid improvement made of late in almost every kind of agricultural implement."\*

If this could be said in 1849, it may be affirmed with much more confidence in 1864. The general diffusion of the best implements at the present time makes the proof much more complete, and much more easy to obtain. Should any one be sceptical, let him visit the premises of some improving farmer. Without doubt he patronises steam, and thus economises horse labour—thrashes his grain in less time—dresses it better for market—leaves less in the straw. He also chaffs his fodder, slices or pulps his roots, and crushes his horse and cattle corn;

\* 'Journal,' vol. x. p. 528.

the result being economy of feeding material, saving of manual labour, and improvement in the condition of his live-stock. Is it seed-time? His drills are so accurate in their work that the horse-hoe can follow when the weeds are yet so young that they are exterminated by the passage of the knives, yet without risk to the young corn. The iron harrows, before and after sowing (zigzag, diagonal, or chain), do more work at one turn than the old country blacksmith's implements did at two or three. If the land be too light, there are the smooth-roller, the fluted-roller, and the clod-crusher. Should it be hay-time or harvest, there are the mowing and reaping machines, the hayspreaders, the horse-rakes, the steel forks, the improved harvest-carts, the Dutch barn, and the rick-stands. This *resumé* might be extended to a tedious length, but it is unnecessary. We have one question, and but one, to ask when the inspection is completed. In this farmer's whole set of machines and implements, *is there one which has not received a prize or medal of the Royal Agricultural Society?* If not, or if, as we believe to be a common case, the exceptions are only such as to prove the rule, then are we in a position to point out not only what an important influence has been exercised by improved machinery in bringing about the agricultural progress which has been realised of late, but also what a large share the Royal Agricultural Society's Shows have had in producing this gratifying result.

*Steam.*—The influence of steam as applied to agricultural machinery still remains to be noticed. Nothing could have been more antecedently improbable than that the costly steam-engine, with its delicate valves, its niceties of adjustment, and its tremendous power for good or for evil, could safely have been entrusted to the care and control of any one but a trained engineer. So thought and so reasoned most thinking men twenty years ago; and of all the working-classes the *agricultural* labourer would have been thought the least likely to be either able or willing to lend a helping hand. How did he receive the introduction of the first piece of machinery which became common on the farm? All who have attained the age of fifty can recollect the quasi-rebellion which, under the name of "*Swing riots*," raged in the southern counties of England when thrashing-machines began to make their way there. The labourers rose in full force to resist this aggression on their rights with fire and flail. Yet in twenty short years the horse thrashing-machines may be said to have come and gone, and the intelligence of the labourer has so advanced meanwhile, that the most labour-saving invention is no longer followed with threats and sullen looks; and of all the obstacles to the introduction of steam-machinery, the least has



been the want of an intelligent workman to take charge of the engine.

The rapidity of the change has been quite unexampled in agricultural history. At the Newcastle Show, in 1846, only one steam-engine was exhibited, which went unrewarded because it had been previously shown and had received a prize; and at a subsequent Meeting the writer can recollect a grave discussion between the Stewards as to the safety of allowing steam-engines to get up their steam in the Society's show-yard. Yet at Worcester there were 135 steam-engines; and one of the successful exhibitors on that occasion has informed us, that though in 1845 he made only one steam-engine, and not one steam thrashing-machine, he has, in the four years 1859-1862, turned out an average of 488 engines and 373 steam thrashing-machines per annum! Since 1852 he has sold enough steam-engines to supply each member of the Royal Agricultural Society with one. He adds, that in the last ten years the average horse-power of the engines made by him has risen from 5·52 to 7·87, an increase of 42 per cent. If the engines furnished by all the makers in the same time could be summed up into a grand total, it would be seen that already many thousands of steam-engines have been purchased for agricultural work; showing clearly that *on the farm as well as in the factory the reign of steam has commenced.*

The truth of this assertion is every day becoming more apparent. In the barn and in the stack-yard the steam-engine is already without a rival. It would be sheer waste of time to give any detailed proof of the superiority of steam to any other available power for barn-work, or any calculation of the exact number of pence per quarter thus saved by the farmer in preparing his grain for market. The feats performed by steam in the way of thrashing, grinding, chaffing, pulping, slicing, have been already chronicled so fully and so frequently of late years as to convince all those who will allow themselves to be convinced by argument. To those who will not, we commend the stubborn fact already mentioned—that *five thousand steam-engines have been sold by one maker since 1852!*

One of the main obstacles to the general introduction of steam-machines was their heavy cost, which was quite disproportionate to the means of a small farmer or the quantity of work to be done on his farm. This difficulty has been surmounted by the intervention of the village capitalist, who has made a comfortable livelihood by purchasing a machine or two, and letting them out for hire to the small farmers in his neighbourhood. In our own district the farms are chiefly small, but thrashing by steam is all but universal, whilst the farmers' own horse-machines are standing idle and fast rusting into oblivion.

Seeing then that steam has ensconced itself in our homesteads, and after ejecting most of their previous occupants, is now waging war with their most ancient denizens, the ploughs and the harrows of "long, long ago," it is surely not premature to inquire the why and the wherefore of this great disturbance. No common motive can have induced men of solid character and fixed habits suddenly to buy hundreds and thousands of costly machines, whose construction they don't understand, and whose adoption forces them to change many of their former plans, and renders useless much of their former expenditure. The answer is at hand. One moving cause, and only one, is powerful enough for the purpose, and that cause is *competition*. The British corn-grower is competing with the corn-growers of all nations, and this competition is continually increasing in intensity. The whole world is, in fact, running a race to secure the best market for their surplus productions; and the repute of our wealth and the universality of our commerce are year by year turning the current more and more towards our shores. The cost of transport to the place of shipment, added to freight and port-dues, once formed a fair set-off against the cheapness of land and the superiority of climate enjoyed by the foreign corn-grower; but the construction of railways abroad and the substitution of steamers for sailing vessels are continually diminishing this margin, and the conditions of the problem which presents itself to the British corn-grower are these:

The increased area from which supplies are now drawn to the British market, and the diminished cost of transport, have so lowered the average price of grain as to make it necessary for the English farmer to reduce his outgoings, in order still to grow corn with profit. These outgoings principally consist of three classes of payments: *rent, wages, and farming expenses*. Has he any prospect of a reduction of *rent*? Is it not notorious that the competition for farms is such that the constant tendency is towards a rise rather than a fall in rents? Can *wages* be lowered? Is it not equally notorious that wages have increased *considerably* in the last ten years, and that they also have a tendency still to rise? The only available expedient, then, appears to be, to reduce the cost of cultivation; and this quarter appears the more hopeful when it is borne in mind that there are two great advantages available in this country of which until of late the farmer has made little use, viz., *the superiority of British machinery and the abundance of British capital*. These have been freely drawn upon by his rivals for the construction of foreign railways, and for the improvement of both British and foreign shipping; but on the other hand, the implement-makers, the joint-stock banks, and the loan-societies have come



to the aid of British agriculture, and have rendered possible the unusual expenditure now being incurred for the purchase of improved machinery, so that this outlay, though apparently rash and hazardous, is really a work of necessity, *an indispensable condition of the British corn-grower's holding his own*. Few farmers probably have reasoned the matter out in this way; but with characteristic sagacity and pluck they have rightly read the signs of the times, and resolutely adopted the remedy.

*Steam-Cultivation.*—The advantages of steam-cultivation, when applied in suitable situations, were well described by Mr. Ruck, of Castle Hill, Cricklade, in a clear and instructive statement, made last May at the opening of a discussion on the subject at the Society's rooms, Hanover-square.\* If all farms were as well adapted for the steam-plough as that of Castle Hill, and if all farmers possessed as much capital and energy as Mr. Ruck, little more need be said on the subject than to wish them every success in their new career.

A large portion of England is, however, let in small holdings, and mapped out in fields of every imaginable size and shape; and it is evidently impracticable in such cases to introduce steam-cultivation as practised by Mr. Ruck, and other large occupiers, whose farms have been duly prepared for the new system. It therefore becomes a question of great interest whether steam-cultivation can only become general when the existing large number of small farms shall have been consolidated into a small number of large ones. In the first place, it is necessary to consider what is implied by the consolidation of farms. It seems but a simple matter for a landowner to issue the fiat. *Let half-a-dozen small farms be consolidated into one large one*; the first idea realised being that some miles of old crooked fences and some scores of hedgerow trees would disappear, and be replaced by a few straight fences, laid out with special reference to the requirements of steam-cultivation. So far all would be serene: land would be gained by the removal of the fences; and the fewer the trees which are tolerated on arable land the better for the tenant, the proprietor, and the public.

The next step is not such plain sailing. Pulling down six homesteads, ill-arranged and incomplete though they may be, and building a good house and set of farm-offices, are expensive operations, and it is neither agreeable nor convenient to repeat them too often in these prosaic days, when Aladdin's lamp is no longer available even to the most devout worshipper of the Prophet. But the

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\* 'Journal,' vol. xxiv. p. 610.

worst remains to be told. Five tenants are turned out ; one only is promoted, if, indeed, any one of the six be found fitted by capital and capacity for doing credit to the new arrangements. *What are these men's offences? and what are they to do for a livelihood?* The landlords of England will require satisfactory answers to these questions before they will pass any sweeping sentence of expatriation upon hard-working, deserving tenants, even to make room for the steam-plough. No doubt opportunities frequently occur when, without harsh measures, farms may be consolidated, and this process is quietly progressing in a natural and satisfactory way ; but *if small farms are never to be cultivated by steam, it will be long, indeed, before steam-cultivation becomes general.*

We are by no means disposed to take a desponding view of the obstacles to be surmounted in the introduction of steam-worked implements on small occupations. Doubtless they are greater than the difficulties which stood in the way of steam-thrashing on such farms, but these were considered insurmountable a few years ago ; and there is no want of inducement to make the attempt, as it is rapidly becoming apparent that even *on light land steam-cultivation will pay*, and that *clay cannot be thoroughly worked by any other means.* It was at one time believed that subsoiling clay by horse-power would effect the deep and perfect tilth which is so great a desideratum and so difficult a task on such land, and when this was the current belief, improving clay-land farmers did not hesitate to incur the heavy expense of 20s. to 30s. per acre to stir and break up the land to the desired depth. The result was neither permanent nor profitable ; but it was not the heavy cost per acre which caused subsoiling clay to be discontinued. *That* was known when the subsoil-plough was purchased. It was the slowness of the progress, and the injury caused by the trampling of so many horses, which prevented the operation from succeeding. Steam-cultivation is free from these objections ; and even on small farms it can be done at much less cost than subsoiling by horses or oxen.

The only real difficulty is the amount of force required to cultivate strong land to a sufficient depth. The best authorities recommend an engine of 12 or 14 horse-power for this work. With such a command of power the strongest clay may be broken up to a sufficient depth steadily and uniformly, or it may be well *stirred, sown, and the seed covered*, at one operation. There can be little doubt that in this way the work can be done in the most perfect, and perhaps also in the most economical way ; and large farmers with sufficient capital will probably never regret having made the outlay requisite to give them full command of

their work. But the desideratum of the present day is to ascertain the best mode of utilizing, for the purposes of cultivation, the many thousand engines which have been already sent out to farmers or small capitalists, and whose average nominal strength is probably about seven horse-power.

Two ways of accomplishing this may be mentioned. The first is, *to reduce the work to be performed*. Instead of using a plough turning three or four furrows, it is perfectly practicable to use one turning two only, and all the other implements may be reduced in proportion. The reduction in the amount of work done in a given time would not be important on small farms; and though the owner of the engine would have to charge a higher rate per acre, it would still answer to the farmer to pay for the use of a steam-plough at particular seasons, in order to break up some unusually stubborn fields, which were quite beyond the strength of his team.

The other plan would be, to combine two engines of moderate calibre, and thus obtain power sufficient to get through the heaviest kind of work. This method has been introduced by several makers, and their respective modes of applying the power of the twin-engines, either alternately or jointly, has been clearly described in Mr. Algernon Clarke's very able and valuable article on the Progress of Steam-cultivation, in the last number of the Journal.\* Hitherto the men who let out steam-thrashing machines have feared to take up steam-ploughing, partly because the demand has not yet become sufficiently general, and partly because a 12-horse engine is too costly, and unnecessarily powerful for the work on which they would be engaged for the greater portion of their time. Steam-ploughing, even when it became general, would not be sufficiently continuous to pay, unless the engine could go to some other work when the land was soft; but if at particular times of year one engine could be sent with a two-furrow plough to a small farm, and two engines with a larger cultivating apparatus for a heavier job, the business of steam-cultivation might be profitably combined with that of steam-thrashing.

These two methods would be equally available to the occupier of a small farm as to the owner of engines who lets them for hire. An engine of 7 or 8 horse-power would pay well on a farm of 250 or 300 acres of arable land, if in addition to its services in the barn it could also, when required, plough effectually 3 or 4 acres of strong clay per diem; and for any work of especial urgency or difficulty, two neighbours might unite their forces, and thus obtain sufficient command of power.

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\* 'Journal,' vol. xxiv. p. 362.

A Steam-plough Company was formed in Gloucestershire, in 1860, under very good auspices, but did not succeed, in consequence of the long periods of enforced idleness which occurred whenever the weather was unfavourable. Another company has been formed at Wakefield, in Yorkshire, which hopes to surmount this difficulty, by undertaking steam-thrashing, sawing, grinding, &c., whenever the engines cannot go on the land. The results, so far, are highly encouraging.

The present position of the question seems to be, that on large arable farms steam-cultivation is a decided success, especially where the land is so laid out that the apparatus can be worked in the most effectual and economical manner.

That on farms of moderate size it can also be applied with advantage, by employing ploughs or cultivators which do not require an engine of higher power than can be usefully employed on ordinary barn-work.

Lastly, that even small farms may derive considerable benefit from steam-cultivation, as soon as companies or private capitalists will undertake this kind of work, which they may do with advantage, either by the employment of small cultivators with one engine of moderate power, or by combining two such on the twin-engine principle.

*Effect of Free Trade.*—The influence of the competition arising from free trade on the demand for improved agricultural machinery has already been pointed out. By the courtesy of the authorities of the Board of Trade, we are now enabled to furnish tables showing the full extent of the competition which British farmers have to meet in their two staple products of corn and meat.

Table (C.) shows the quarters of wheat, barley, oats, maize, peas and beans, and the hundredweights of flour imported in each of the years 1839-1862. Large as these quantities undoubtedly are, we are satisfied that they do not warrant the opinion generally entertained that, since the adoption of free-trade, the importation of foreign wheat and flour has been increasing faster than the consumption—or in other words, that the production of wheat in this country is declining, and that its place is being supplied by importation. It is much to be regretted that on a question of so much interest to the agriculturist, the capitalist, and the statesman, we should have no reliable statistics by which to test the correctness of this opinion. Indirect proof is all that can be adduced. We trust that it will be considered conclusive.

The most superficial examination of the accompanying table will show that a very large increase in the importation of wheat



TABLE C.—GRAIN IMPORTED INTO THE UNITED KINGDOM.

Years.	Wheat.	Barley.	Oats.	Maize.	Peas and Beans.	Wheat-meal.
	Quarters.	Quarters.	Quarters.	Quarters.	Quarters.	Cwts.
1839	2,638,593	579,405	674,554	9,565	249,822	793,606
1840	1,995,453	625,437	537,805	22,021	287,904	1,552,697
1841	2,409,754	264,654	122,297	4,137	442,253	1,275,656
1842	2,722,305	73,550	302,852	35,866	219,830	1,151,827
1843	932,866	179,414	84,718	516	97,051	440,955
1844	1,097,963	1,025,416	308,126	39,218	261,780	987,774
1845	844,533	367,854	586,860	55,984	265,621	924,256
1846	1,437,336	371,137	794,863	694,184	468,050	3,363,810
1847	2,650,058	772,840	1,706,780	3,614,637	600,964	8,637,377
1848	2,477,366	977,203	930,265	1,577,023	668,160	1,731,974
1849*	3,845,378	1,381,008	1,267,106	2,224,459	692,299	†3,349,839
1850	3,738,995	1,035,903	1,154,473	1,277,071	619,720	3,819,440
1851	3,812,008	829,564	1,198,529	1,807,636	417,623	5,314,414
1852	3,060,268	625,540	989,287	1,471,277	477,306	3,865,173
1853	4,915,430	824,068	1,028,409	1,544,483	450,655	4,621,506
1854	3,431,227	552,972	1,014,949	1,349,698	494,843	3,646,505
1855	2,667,702	349,110	1,033,727	1,215,333	458,427	1,904,224
1856	4,072,833	731,412	1,146,848	1,777,813	439,300	3,970,100
1857	3,437,957	1,701,470	1,710,299	1,150,783	465,674	2,178,148
1858	4,241,719	1,661,392	1,856,281	1,750,825	570,006	3,856,127
1859	4,000,922	1,727,855	1,677,585	1,314,303	500,502	3,328,324
1860	5,880,958	2,112,861	2,290,951	1,851,762	754,035	5,086,220
1861	6,912,815	1,400,401	1,859,781	3,090,352	960,330	6,152,938
1862	9,469,270	1,854,944	1,609,816	2,728,791	703,048	7,207,113

\* Import duty 1s. per quarter from 1 Feb. 1849.

† Import duty 4½d. per cwt. from 1 Feb. 1849.





								Qrs.
Average quantity of wheat and flour (calculated as wheat) imported in each of ten years, 1839-1848 .. .. .								} 2,529,637
Ditto, 1850-1859 .. .. .								
								<hr/>
Average increase .. .. .								Qrs. 2,273,568

The results obtained by comparing the *first* and *last*, or the *first five* and *last five*, or the *first ten* and *last ten*, of the twenty-one years under consideration, are thus so nearly the same, that no material error can in this case arise from basing our calculation on the comparison between the single years 1839 and 1859, the first and last of the series; the difference in the quantity of wheat imported in those years being 2,101,622 quarters.

The next step is to ascertain the increase of the population in the period under consideration; and this we find, from the Census Tables for England and Wales, to have been 4,127,819. The ordinary estimate of the consumption of bread-corn by a wheat-eating people is one-quarter (of 8 bushels) per head per annum. We have satisfied ourselves by careful inquiry that this is as near an approximation to the truth as can be expected from a rough-and-ready rule of the kind. The population of England and Wales would therefore require 4,127,819 more quarters of wheat in 1859 than would have sufficed in 1839. The increase of importation of wheat and flour (calculated as wheat) in 1859 over 1839 was 2,101,622 quarters. The balance therefore of 2,026,197 quarters of annual supply must have been provided by the increase of our home-grown wheat, or our population must have been *much worse fed than heretofore*, the very reverse of which we know to be the fact.

We do not pretend that this is an accurate estimate, or even a close approximation; but we feel little doubt that it may be taken as the *minimum* increase of our home-grown supply, and that it is, in fact, much below the actual increase if that could in any way be ascertained. That this is so the following considerations will show:—In the first place, the increase of the population is an ascertained fact, and the estimate of eight bushels of wheat per head of annual consumption in England and Wales, which has been verified by the accounts of many different families and taken as a basis of calculation by various writers, is in all probability not far wrong. If these data be granted, the amount of increased consumption is proved, and that portion of it which has not been imported must have been grown at home. But during the twenty-one years in question the ordinary wages of daily labour have risen at least 20 per cent., and barley-scones and oat-cakes have almost disappeared as articles of regular diet.

The construction of railways, docks, and other large public works, has created a numerous class of navvies, plate-layers, and well-paid officials, whilst the great extension of our staple industries has provided more constant and more profitable employment for our artizans and labourers than heretofore; so that both on account of our labourers having the means of supplying their families more liberally with food, and of wheat becoming more and more the staple diet of the million, we are convinced that a much larger addition is required to our present supply of wheat than would be necessary merely to feed the additional mouths according to the old standard rate per head. It follows then, as a matter of course, that the increase in the home-production of wheat between 1839 and 1859 was considerably in excess of the two million quarters, which we have endeavoured to prove to have been the *minimum*. It is satisfactory to feel that our large importations are not displacing home-grown corn, but that the skill of our farmers has been no less effective than the enterprise of our merchants in obtaining the large additional supply of food required by an increasing population.

The immense resources of our capitalists and our shipping have never been more strikingly exemplified than in the facts which this Table places prominently before us. The deficiency caused by a succession of three unusually bad harvests has been supplied from other countries to the extent of 4,410,546 quarters of wheat annually over and above what may be called the customary amount, viz. the average of the previous ten years, without any disturbance of the money market and almost without any one being aware of what was going on,—except the importers, who each year provided the requisite ten or twelve millions sterling, and the farmers, who received that much less for their crops. Doubtless the loss has fallen heavily upon them, and had it not been for the help afforded by the remunerative prices of stock, wool, and dairy produce, many must have succumbed. To the decrees of Providence, however, all must bow, and had it not been for Free-trade, what would have been the result? Restricted supplies—high prices—a suffering and discontented population—and last, but not least, *the consciousness that their sufferings might have been prevented.*

*Free Trade in Cattle.*—Table (D.) shows the total importations of cattle, sheep, and swine, from July 9, 1842, the date of the removal of the prohibition, to December 31, 1862. It will be seen that so long as an import-duty of even 1*l.* per head was levied on cattle, and 3*s.* per head on sheep, the numbers imported were trifling; but that a considerable increase took place immediately after 1846, when the trade was made entirely free.

TABLE D.—CATTLE, SHEEP, and SWINE Imported into the United Kingdom.

Years.	Oxen and Bulls.	Cows.	Calves.	Sheep and Lambs.	Swine.
	Number.	Number.	Number.	Number.	Number.
*1842	3,156	1,038	70	644	410
•1843	1,114	368	39	217	361
1844	3,682	1,154	53	2,817	265
1845	9,743	6,503	587	15,957	1,590
†1846	17,191	25,349	2,503	94,624	3,856
1847	27,831	35,480	12,406	142,720	1,242
1848	24,590	22,506	15,642	130,583	2,119
1849	21,884	17,920	13,645	129,266	2,653
1850	28,951	17,757	19,754	143,498	7,287
1851	37,624	24,026	24,870	201,859	15,599
1852	40,533	25,038	27,490	230,037	10,524
1853	56,220	38,328	30,705	259,420	12,757
1854	62,937	25,271	26,130	183,436	11,077
1855	63,687	10,063	23,777	162,642	12,171
1856	52,019	9,843	21,444	145,059	9,916
1857	53,277	12,371	27,315	177,207	10,678
1858	47,912	14,106	26,983	184,482	11,565
1859	55,960	7,334	22,383	250,580	11,084
1860	70,023	6,987	27,559	320,219	24,452
1861	71,288	9,906	25,902	312,923	30,308
1862	64,461	4,357	29,069	299,472	18,162

\* July 9, 1842.—Prohibition to import Live Stock removed. Duty imposed on Cattle of 20s. ; on Sheep of 3s. ; and on Swine of 5s. per head.

† From March 19, 1846.—Free of Import Duty.



If the sixteen years succeeding 1846 be divided into four equal periods of four years each, as in Table (E.), it will be found that the trade in cows, which was considerable for a few years after the ports were opened, soon declined, and has been pretty nearly abandoned; but that the number of prime animals (the bulls forming a very inconsiderable portion of the numbers in the 1st column) has increased steadily, though not rapidly. The sheep, though with considerable fluctuations, have also increased.

TABLE E.—CATTLE, SHEEP, and SWINE Imported into the United Kingdom.

	Oxen and Bulls.	Cows.	Calves.	Sheep and Lambs.	Swine.
	Number.	Number.	Number.	Number.	Number.
Average of 4 years—					
1847 to 1850, inc.	25,814	23,415	15,361	136,516	3,325
1851 to 1854, inc.	49,328	28,165	27,298	218,688	12,489
1855 to 1858, inc.	54,223	11,595	24,879	167,347	11,082
1859 to 1862, inc.	65,433	7,146	26,228	295,798	21,001

We have unfortunately failed in our attempts to obtain any reliable statement of the number of live stock brought to market in the principal cities and towns of the United Kingdom, so that we are unable to ascertain the proportion which the live stock imported bears to the whole consumption of the country. That it is but a small fraction of the entire supply is however evident by comparing the accompanying Tables (E.) and (F.),\* from which it appears that the average number of cattle imported in the four years 1859-1862, were barely 25 per cent., and the sheep only 19 per cent. of the average numbers brought to market in those years in the metropolis alone.

Table (F.) embraces a period of thirty years, and dividing it into three equal periods of ten years each, Table (G.), we find, by comparing the 2nd decennial period with the 1st, that there has been an increase in the annual supply of *cattle* of 27 per cent.; and similarly comparing the 3rd period with the 2nd, that there has been a further increase of  $22\frac{1}{2}$  per cent. In the case of *sheep*, however, the increase in the 2nd period was only  $11\frac{1}{2}$  per cent.; and in the 3rd period, there has been a falling-off of 116,642 head annually, or 7 per cent. of the whole number of sheep

\* This Table has been kindly furnished by the authorities of the City of London. For the continuation, subsequently to 1854, we are indebted to the officers of the Board of Trade.



TABLE F.—CATTLE, SHEEP, CALVES and PIGS brought into Smithfield Market in each Year from 1833 to 1854; and into the Metropolitan Cattle Market, from 1855 to 1862.

	Beasts.	Sheep.	Calves.	Pigs.
	Number.	Number.	Number.	Number.
Brought into Smithfield Market.	1833	154,943	1,206,730	18,361
	1834	174,837	1,364,470	19,647
	1835	183,101	1,563,500	20,807
	1836	177,334	1,343,770	19,222
	1837	186,336	1,460,160	17,659
	1838	199,369	1,540,280	18,651
	1839	193,322	1,481,920	18,321
	1840	186,955	1,527,550	17,186
	1841	176,658	1,432,040	17,134
	1842	191,075	1,655,370	19,447
	1843	187,547	1,817,460	19,131
	1844	197,837	1,804,850	19,117
	1845	204,055	1,539,660	18,512
	1846	213,525	1,527,220	19,875
	1847	240,668	1,548,350	25,506
	1848	240,293	1,450,350	28,842
	1849	243,761	1,624,230	26,301
	1850	251,137	1,658,330	30,145
	1851	261,672	1,660,850	33,237
	1852	278,616	1,630,480	36,188
Brought into the Metropolitan Cattle Market.	1853	292,329	1,530,550	36,316
	1854	282,828	1,616,560	30,808
	1855	272,916	1,552,920	27,370
	1856	268,996	1,422,250	24,713
	1857	272,843	1,391,960	29,706
	1858	289,504	1,463,235	26,260
	1859	274,489	1,552,440	24,020
	1860	295,018	1,570,090	27,309
	1861	289,380	1,496,860	26,399
	1862	304,741	1,498,500	27,951

brought to market! This diminution in the supply has occurred, too, when, in consequence of the high prices of both wool and mutton, there has been a strong inducement to flockmasters to increase their production to the utmost extent. The deficiency may to some extent be accounted for by the largely increased quantity of meat sent to Newgate and Leadenhall markets. The supplies sent to these markets consist partly of meat killed in the metropolis, the live stock having been purchased in the Metropolitan Cattle Market: this has already been taken into account. The remainder consists chiefly of meat conveyed by railway.

TABLE G.—CATTLE and SHEEP brought into Smithfield and the Metropolitan Cattle Market.

	Average of the 10 Years, 1833-1842.	Average of the 10 Years, 1843-1852.	Increase (Numbers).	Increase Per Cent.	Average of the 10 Years, 1853-1862.	Increase (Numbers).	Increase Per Cent.
Cattle	182,393	231,911	49,518	27	284,304	52,393	22½
Sheep	1,457,579	1,626,178	168,599	11½	1,509,536	Decrease. 116,642	Decrease Per Cent. 7

Comparing a return lately obtained from the principal Railway Companies which convey meat to the metropolis with a return furnished by the same Companies 10 years ago, it appears that the quantity of meat so carried has increased during the intervening period about 37 per cent. Supposing this to consist of beef and mutton in equal proportions, the additional 13,400 tons carried would give 6,700 tons of mutton, representing—if 80 lbs. be the average dead weight of a sheep—a goodly flock of 187,600 head.\* If mutton form the larger portion of the consignments, as appears probable (say as 5 to 3), the number of sheep conveyed by rail to the metropolis as dead meat now would be 234,500 more than were similarly carried ten years ago. The falling off in the number shown at Smithfield during the same period was 116,642, leaving a balance of increase of 117,858. This increase in the number of live and dead sheep brought to market in the metropolis is not, however, derived from our own country; as it will be seen in Table (D.) that the average importations of sheep in the 4 years ending 1862 had increased by 119,658 over the average impor-

\* No accounts are kept of the relative proportions of beef and mutton forwarded by railway.

tations in the 4 years ending 1852; so that, judging by the supplies sent to the metropolis (no bad test), it is pretty certain that the *number of British sheep sent to market has been for the last ten years stationary, if not retrograde.*

The supply of meat sent by railway consists, to a great extent, of prime joints, and consequently represents a greater number of head of live-stock than an equal weight of meat sent to market in the ordinary way (by the carcass). This consideration, however, cannot affect our calculation to any appreciable extent. Take the case of 100 sheep slaughtered at Norwich, where this trade is largely carried on. The fore-quarters of the whole 100 sheep are now consumed at Norwich, and the same consuming power would formerly have been supplied by 50 sheep slaughtered and wholly disposed of there. The other 50 would have been sent to London alive; whereas now the inhabitants of Norwich are willing to purchase the inferior joints at a lower price, and the consumers of the metropolis are also willing to pay for the privilege of having the hind-quarters of the whole 100 sheep *without* the inferior joints. It is, therefore, a mere transfer of the best parts of the animal to the best market, and does not of itself give any indication either of increase or decrease in the number slaughtered.

The slow rate of increase of our home-grown supplies of sheep becomes still more striking if we compare the number sent to the Metropolitan Market now with the number sold in Smithfield Market 40 years ago. In 1822 the number of cattle sold in Smithfield Market was 142,043, and of sheep 1,340,160. In 1862 the number of cattle brought into the Metropolitan Market was 304,741, and of sheep 1,498,500; so that whilst the cattle have increased *114 per cent.*, the sheep have increased not quite *12 per cent!*

Strong corroborative evidence of the increasing scarcity of sheep is afforded by the great rise which has occurred in the price of mutton within the last ten years. This has also to some extent affected the price of beef, notwithstanding good supplies of fat cattle.

The following comparative statement shows that between 1852 and 1862 the price of mutton has advanced 1s. 4d. per stone of 8 lbs., and that the stone of beef has advanced 10d. in the same time. This statement applies only to the "*prime*" or best quality of meat. Inferior mutton has in the same ten years only advanced 7d., and inferior beef 5½d. per 8 lbs. It is common when comparing the prices of meat at different periods to take the average of different qualities. We prefer confining the comparison to the prime qualities, as the price of inferior meat is regulated much more by the proportion of inferior animals to

the whole number shown, and by the more or less injured state, from disease or travel, in which they come to market, than by the general supplies of live-stock brought forward for consumption. In other words, the price of inferior meat is dependent not only on the quantity at market, but upon its degree of inferiority; whereas prime meat is subject to but little variation in quality, and its price is therefore the safest measure of the comparative plenty or scarcity of live-stock at different times.

Average Price of prime MUTTON and BEEF by the carcass in the  
Metropolitan Markets.\*

	Average of 5 Years, ending 1853. (Per Stone of 8 lbs.)		Average of 5 Years, ending 1863. (Per Stone of 8 lbs.)		Increase in 10 Years.	Increase Per Cent.
	s.	d.	s.	d.	s.	d.
Beef .. ..	4	2½	5	0½	0	10
Mutton .. ..	4	5	5	9	1	4

This great advance in the price of meat offers a strong inducement to farmers to add to the numbers of their live-stock of all kinds; but in the case of sheep, the long period during which their rate of increase has failed to keep up with the increase of consumption, makes the augmentation of our sheep-stock one of the most important farming questions of the day.

Having thus passed in review our supplies of corn and meat for some years past, especially marking the effect of Free Trade upon both, we unavoidably arrive at the following conclusions:—

1st. That, except on those rare occasions when deficient harvests may occur simultaneously over a large proportion of the corn-growing regions of the world, the supplies of grain sent to this country are likely to be so considerable as to keep prices at a lower level than would be remunerating if corn-growing were considered (as it too often has been) a department of farming which is complete in itself.

2nd. That the enormous quantity of foreign corn imported of late years has maintained in strength and comfort a much larger labouring population than could otherwise have been supported in Great Britain, and has enabled our manufacturers and commercial men largely to extend both their home and foreign trade.

\* The figures on which these calculations are founded are taken from Herbert's paper, 'Journal,' vol. xxiv. p. 456.



The wealth of this country has thus been so rapidly augmented as to create a consuming power which has increased the demand for meat more rapidly than either our own or foreign producers have been able to supply it.

3rd. That the breeding and feeding of live-stock have thus become such profitable operations that the growth of corn, *as a sequence to stock-farming*, has also become profitable even at present prices. Paradoxical, therefore, and unsound as it would have been thought twenty years ago, it is no less true, *that though Free Trade has discouraged bad farming in the shape of simple corn-growing, it has, on the other hand, given a powerful stimulus to good farming by making it possible still to grow corn with profit through the intervention of green-crops and live-stock.*

*Tenure of Land.*—The comparative advantages of leases and agreements terminable at short notice, have been much discussed of late, though little progress has hitherto been made towards a settlement of the question, or in making converts from one side to the other. The advocates of leases contend that under their system there are: 1st, Fewer instances of bad farming, which is *important to the public*; 2ndly, greater security for capital invested, which is *important to the tenant*; and, 3rdly, higher rent paid for the land, which is *important to the landlord*. On the other hand, it is argued, with reference to the first point, that there are numerous instances of properties, especially large properties, where the land is in quite as high a state of cultivation without leases as if held for a long fixed term, and consequently that when a property is badly farmed it is not the fault of the tenure, but of the agents or managers. There is considerable truth in this remark; but it is not entirely conclusive, as there are undoubtedly many poor and ignorant farmers who are allowed to hold on, as tenants at will, but to whom leases would never be granted, and who therefore on a general adoption of that system would have to make way for men of greater capital and energy. The second and third points cannot be denied. If, therefore, the case be argued on commercial principles alone, the advocates of leases have the best of the argument, and *doubtless in the long run this view of the matter will prevail*; but there are important social questions connected with it, which have hitherto prevented the general adoption of leases, and will continue to exercise a powerful retarding influence. Most landlords who let their land to tenants-at-will are aware that they could increase their rents by granting long leases; but before realising this additional income tenants must be changed, farms consolidated, and farm-buildings augmented and improved.



Of these obstacles the least are those connected with providing the requisite capital. Many landlords have funds at their disposal which they would be happy to invest on such undeniable security as their own land, especially to obtain such a liberal return as a moderate increase of rent would supply, and which, if the outlay were judiciously made, would be cheerfully paid. The owners of encumbered or settled estates have also such facilities of obtaining advances either from Government or private companies that some more influential reasons than the want of funds must be found before the very slight progress made by the lease-system can be explained.

One of the most general of these causes is dislike on the part of landowners to dispossess deserving tenants, many of whom have held the same farms from father to son for generations, and between whom and their landlord there exist personal ties, which, if rudely severed, would be most inadequately replaced by a few shillings an acre additional rent. Another equally influential cause is the repugnance of the proprietors to give up so much of the control over their estates as is implied by a lease for any long term of years. They let their land below its market value, for the sake of retaining the power of resuming possession, at short notice, of any farm on which the tenant causes annoyance to his landlord, or sets a bad example to his neighbours. The knowledge that such a power exists makes it rarely necessary to exercise it.

It must not, however, be supposed that objections to leases are only to be met with amongst landowners. Many tenants dislike the idea of being bound down for a term of years "for better for worse, for richer for poorer," and if coupled with a moderate increase of rent, leases would, we are persuaded, be declined by a majority of tenants at will. On a property in the north of England, entirely held under agreements terminable at six months' notice, the writer once offered nineteen-year leases, on the Scotch principle, to the whole of the tenants. They took time for consideration, but eventually declined them to a man. On being asked their reasons, they said "they considered that under their existing tenure the advantage was all on their side, for if farming prospered, they were sure they should not be disturbed, and if bad times should come, their hands would not be tied."

As these causes will probably long continue to operate, it is worth considering whether there are any practicable means of at once mitigating the evils arising from the very prevalent custom of letting farms at will, or on agreements terminable at six months' notice. These evils, though apparently of very different kinds, such as injury to the public by the inadequate cultivation of the land, and injury to the tenant, who, without sufficient cause, is suddenly

dispossessed of his holding, are all referable to the same cause, viz., want of sufficient security for the capital of an improving tenant. The ingenuity of practical men has long been concentrated on this weak point in the present system, in the hope of devising such conditions as shall secure to an outgoing tenant repayment of the bulk of the capital laid out by him in recent improvements. An almost innumerable variety of covenants has thus been introduced into agreements in different parts of the country. Some of these are of a very complicated kind, and require from an entering tenant a large advance of money which is said to have been disbursed by the previous occupier, but which his successor has little power of verifying. Many a first-rate tenant has been deterred from taking farms hampered by agreements of this kind, as, instead of leaving him the master of his own capital, they oblige him to pay the cost of operations which, if honestly carried out, he would probably only partially approve, and if "scamped" would amount to a direct robbery. Doubtless the great majority of tenant-farmers would scorn to take advantage of the opportunity thus afforded for roguery, but out-going tenants are frequently needy men, and the temptation ought not to be thrown in their way. The principal object of these covenants is to reimburse to the outgoing tenant as large a portion of his outlay as is consistent with justice to his successor, which would probably be best attained by somewhat lengthening the requisite notice to quit. If 18 instead of 6 months were required in order to terminate a tenancy, the occupier would have the opportunity before he left of taking *one crop of corn from the whole of his arable land*, which would much simplify the conditions required for the protection of the outgoing tenant, and much diminish the amount to be paid by the incoming one. Where land is in high condition, the power of taking one crop of corn all round is of such obvious justice that it is unnecessary to support it by argument; and even where the land is poor and ill-farmed the tenure for one year longer would not enable the occupier unfairly to prejudice his successor, if his agreement restricted him (as all agreements should do) from taking two white crops in succession.\*

When the principles of cultivation, manuring, and the nutrition of plants were much less understood, both by landlords and tenants, than they are at present, the greatest care and consideration were bestowed upon agreements, with a view to enforcing a particular course of cropping, and even in some cases of fixing the quantity and quality of lime, manure, &c., to be applied.

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\* This is quite compatible with special arrangements whereby safe tenants may be permitted to crop as they please, except when under notice to quit.

Any considerable deviation from the four-course system of husbandry was then believed to inflict such injury upon the land that letting a farm so treated would be like selling a lame horse, and would require a heavy sacrifice on the part of the owner. Now, however, no one disputes that "condition" can be restored to the land by a certain amount of exposure to the atmosphere and a certain amount of manuring, the materials for which can be purchased at most market-towns. In short, it is a mere question of a moderate amount of money applied with ordinary discretion, and not, as was formerly thought, the happy result of *much money* applied with *great skill* through an *indefinite period of years*, and which, when realized, ought to be guarded like the golden apples of famous memory.

The evident tendency of the present day is to make agreements extremely simple, to allow an in-coming tenant to be as little hampered as possible by the operations of his predecessor, but to devote the capital, whose possession ought to be a *sine qua non*, to a thorough stocking and manuring of his farm, instead of battling about tillages and half tillages, and expending his capital on "*unexhausted improvements*," the existence of which is in many cases highly problematical. In order to combine freedom to the in-coming with justice to the outgoing tenant, the suggestion already made is thrown out with some confidence, viz., to give to all tenants-at-will an additional year's notice, and thus enable them to reimburse themselves instead of hampering their successors.

*Improvements in Cultivation and Farm Management.*—To a *bonâ fide* agriculturist the most interesting part of agricultural progress is that connected with cultivation and farm management; and the improvements to be noticed under this head are neither few nor unimportant. But though numerous and of various kinds, they chiefly spring from one source, which in itself is the most characteristic feature of the period in question, and may be described as the substitution of sound reasoning and arithmetical calculation for the empirical knowledge so much relied upon by our ancestors. That mixture of tradition and guess-work was certainly valuable in the absence of any sounder system, but was never to be relied upon when the circumstances under which it was acquired, whether of soil, season, or situation, were materially altered. In the first book of Euclid there is a proposition near the commencement which is familiarly known as the "Asses' Bridge;" and undoubtedly any student who makes himself thoroughly acquainted with that theorem has made an important step towards mastering the Elements of Geometry. In the past twenty-five years agriculturists have similarly bridged



over and successfully passed the great gulf which separates the *rule of thumb* from the *rule of three*. The man who paved the way for their advance, and manfully led the van through year after year of costly, intricate, and ill-appreciated labour, was Mr. Lawes, of Rothamsted. He it was who taught us that the soil has a natural standard of fertility, which enables it without the aid of manure to produce year after year a certain number of bushels of wheat or other grain. On his own farm at Rothamsted, though the land is by no means of first-rate quality, this average is about 16 bushels of wheat per acre, and has not diminished, though twenty-four crops of corn have been taken successively, of which the last twenty have been wheat. This has been done not only without the application of any kind of manure, but also without the intervention of any fallow or fallow crop.

It must be borne in mind that this average produce varies, within certain limits, according to the character of the season, and that it may be reduced by bad management, such as improper seeding or foulness of the land. But, with fair play, *all land has a certain standard of natural produce*. Such is the important proposition which Mr. Lawes has worked out under the eyes of the nation, and which must in future form the basis of all rational farming. In order to appreciate the full importance of this discovery it is only necessary to look at the new light thus thrown on the nature and capabilities of the soil. Twenty years ago, what could be more unintelligible than the terms used to describe the comparative fertility of different farms? Such a one was said to be in "*high condition*;" such another was "*out of condition*." Who could define "*condition*"? It was considered a kind of mystery, of the real nature of which the experienced practical man was favoured with occasional glimpses, but which it was hopeless to attempt to explain to the uninitiated.

Now that we know that land has a natural store of the materials required for the production of grain, which confers upon it a certain moderate standard of fertility, we have the key to the solution of this mystery. Land that is thoroughly run out means land that is reduced to its original standard of productiveness. Any "*condition*" that it possesses in addition to this, be it more, or be it less, consists simply of the *remains of previous crops and previous manurings*. We are designedly leaving out of consideration all questions of tidy or slovenly management, such as those connected with draining, fencing, weeding, &c. If wet land be undrained, its standard of fertility will clearly be lower than if drained: if drained land be neglected, and the outfalls allowed to choke up, it will revert more and more towards the naturally lower standard of the undrained land; if land be divided into small fields, and high overgrown fences or hedgerow-trees be

allowed to overshadow the crop, or the corn be smothered with weeds, even the small natural produce may not be reaped from the land. But all these faults are visible on the surface, and with respect to the unseen capabilities of the soil itself we now know, that nothing short of the most wilful and long-continued cropping without any return whatever—something worse even than Mr. Lawes's twenty-four successive crops without manure or fallow—can materially injure the staple of the soil. It follows that, after any ordinary amount of bad farming, sufficient manure of the right kind will quickly restore to the soil, not its natural productiveness, which it is scarcely possible to destroy, but that acquired fertility which we may now describe as "*good condition*," without fear of being misunderstood.

But this is far from being all that we have learnt at Rothamsted. When a farm has been reduced by bad management to a low state of productiveness, what is the right manure to apply? In 1864 the merest tyro in farming can answer this question. *Nitrogen for corn—phosphorus for turnips*—are household words. Twenty years ago what would have been the stereotyped answer? "The midden is the mither of the meal-kist." This is a maxim of much practical sagacity; but unfortunately for the owner and occupier of an impoverished farm in old days, the midden could not be extended *ad libitum* when it was wanted over the whole farm at once; and accordingly years were expended and patience sorely tried before the traces of hard cropping and scanty manuring could be effaced.

The great benefits conferred upon agriculture by Mr. Lawes have been stated in strong terms. It must not, therefore, be supposed that there is any wish to ignore or depreciate the labours and discoveries of Boussingault, Liebig, and other eminent men of science. Their analytical investigations, by showing us of what materials our crops were composed, formed a sound basis and an indispensable starting-point for Lawes's experiments. In an agricultural article it is not necessary to do more than offer a cordial tribute of acknowledgment to men whose reputation in the annals of science is world-wide.

The great difference in value to agriculturists between the labours of Lawes and those of the scientific men who had preceded him may be illustrated by the familiar toy known as the "Chinese puzzle." The puzzle had been taken to pieces by previous investigators. Lawes set to work to put it together again. They said (for instance) *wheat* is composed of certain chemical substances, in stated proportions. Lawes tried if, by restoring these materials to the soil, he could get back the wheat, or (which amounted to the same thing) get an additional quantity of wheat from the land; and he followed up



this first idea by the no less important inquiry : If these materials will not do, *what will?*

It would far exceed the limits of this article to attempt any description of Lawes's extensive series of experiments. It would also be a work of supererogation, as they have been described by himself and Dr. Gilbert in this Journal, from time to time. But whilst endeavouring to describe the agricultural progress realised during the last twenty-five years we wish to record our deliberate conviction that there has not during that time been any addition made to our knowledge which approaches in importance to the *insight obtained into the true principles of cropping and manuring* on the experimental farm at Rothamsted.

It will probably not be considered unpardonable egotism in the writer to place next in importance to the Rothamsted results the discovery which he first had the pleasure of announcing to agriculturists, viz., *the absorbent power of soils*, or the power possessed by the soil of decomposing and retaining for the sustenance of plants the ammoniacal and other salts which form the most valuable constituents of manure.\* This principle, which was further investigated and much extended by Professor Way, formed the subject of several valuable papers in the Journal, from his pen.†

The true principles of *land drainage* have been keenly discussed during the period under consideration, and have to a great extent been settled by common consent, the exceptions being chiefly due to peculiar geological combinations or irregularities confined to particular localities. Our increased knowledge of the art of draining will be best appreciated by again referring to Mr. Pusey's Address of March, 1839. Speaking of Smith of Deanston's system, he says, "it is impossible to pass it over, although, of course, its introduction is too new to be placed already altogether beyond the reach of disappointment. Mr. Smith's mode of dealing with a clayey subsoil which holds up in the soil the water that has fallen in rain, and thus exerts some unexplained evil influence on plants fitted for the food of man or of cattle, is as follows." . . . After describing the plough and its mode of action, he continues : "The share of the subsoil-plough following, passes through and splits the whole of the subsoil to the depth of 18 or 20 inches, and the rain-water sinks, of course, so much lower. Mr. Smith, however, does not allow the rain to lodge here ; he has previously dug covered drains about 3 feet deep, made thus deep in order that his underground plough may have room to pass over the covered channel." . . . It thus ap-

\* 'Journal,' vol. xi. p. 68.

† Ibid. vol. xi. p. 313 ; vol. xiii. p. 123 ; vol. xv. p. 491.

pears that twenty-five years ago the best-informed man of his day on agricultural topics considered that furrow draining was "too new to be *altogether beyond the risk of disappointment*;" that the mischief caused to vegetation by stagnant water was "*unexplained*;" and that, in his opinion, Smith of Deanston's only motive for making his drains 3 feet deep was to *put them out of the way of his subsoil-plough*.

The great addition made to the resources of the agriculturist, by the extensive supplies of what are termed *artificial manures*, cannot be left unnoticed, though the annual importation of some hundreds of thousands of tons of guano, nitrate of soda, &c. &c., has become of late years so much a matter of course that it is difficult to realise the fact, that twenty years ago this trade had barely commenced. During the Liverpool Meeting of the Royal Agricultural Society, in 1841, the writer, in company with the late Mr. Pusey, visited the well-known establishment of the Messrs. Skirving, where a sample of the first cargo of Peruvian guano was shown them as a great novelty.\* At that time the supply of artificial manures consisted of very moderate importations of bones and rape-cake; and, with these exceptions, the British farmer's command of fertilizers was confined to the sweepings of his chimneys and the contents of his own farmyard. This seems almost as incredible at the present day as would have been the announcement, in 1839, that a score of years would not pass before a numerous fleet of vessels would be permanently engaged in the artificial-manure trade, and when the mountain ranges of Europe, the plains of America, and the islands of the tropical seas would all be ransacked for materials to enrich our turnip-fields, and thus enable us to increase our flocks and our herds. Yet those who looked somewhat incredulously on the brown, effete-looking substance then known by the Spanish name of "*huano*," have lived to see it become one of the principal means by which British agriculture has succeeded in producing the quantity of savoury chops and much-loved roast-beef required to satisfy the cravings of John Bull and his numerous family.

The proper *management of manure*, whether liquid or solid, has since 1839, been removed from the region of guesswork, and is now regulated by simple maxims founded on the ascertained processes of chemical decomposition. The mode in which the foregoing and other fundamental principles recently incorporated in the agricultural code act as guides to the practical farmer, will probably be placed before the reader in the most intelligible and connected form by describing in general terms the

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\* The first *consignment* of guano to this country consisted of thirty bags, sent July, 1839, to Messrs. Myers and Co. of Liverpool.

management of an imaginary farm, taken in hand by an advanced and improving agriculturist in 186—. We will suppose it to be thoroughly unimproved and out of condition; and as the clays present the most difficulties, we will commence with a clay farm *wet, foul, and poor*.

It may be well to premise that the entire description of this imaginary farm is derived from the writer's own observation and farming experience, though of course not all collected at one time or in one place.

The first object is to make the land dry; and our entering tenant is informed that "this farm cannot be drained; that all methods have been tried, but that it is as wet as ever; and that it's of no use wasting any more money upon it." He examines the drained fields, which are of three kinds. One is on a hill-side, and the drains are carried across the slope. He finds that in consequence of the deadness of the fall in the drains, and the sharpness of the slope of the land itself, the water not only makes its way *into* the drains but *out* of them again, and that the adjoining land is, as represented, wet as ever. He resolves to drain this land sufficiently up and down the hill to ensure the fall in the drain being more than a match for the fall of the land.

The second drained field is a strong loam, though in its present sodden state it has all the appearance and most of the attributes of the stiffest clay. Here the drains have been placed in the furrows, as the lands were high and beautifully rounded, and the previous tenant considered himself deeply in their debt for preserving a portion of his crop from the baleful influence of the stagnant water which remained all the winter in the intervening furrows. He therefore, in his care to preserve their form, rather added to than diminished their rotundity. On examination it is found that the reason why this land won't drain is solely its defective form. When land is flat each square foot of surface has only to dispose of the rain which falls upon it, but if laid in high-backed ridges, a large portion of the rain runs into the furrows, and carries with it the finer particles of soil and manure, thus effectually choking the natural pores and interstices of that portion of the land where the bulk of the water is accumulated. After a few heavy rains these furrows hold water like a dish, and the vegetation for some feet on each side of them is starved and stunted. On digging into this land it is found to have thin veins of sand which contain much water, and it is of importance to tap these Lilliputian springs as low as possible without incurring too much expense. Our *novus homo* consequently resolves to put in his drains 4 feet deep, and the mains 6 inches deeper. The curvilinear shape and

irregular width of the lands make it necessary to neglect them altogether, and he lays out his drains 10 yards apart, having regard to the best obtainable fall, mentally resolving gradually to reduce the height of the lands until the whole can be brought to a level surface.

The third and last attempt at drainage that had been made on the farm was in a field of pure unsophisticated clay. Both tenant and agent were convinced it would not answer, but some meddlesome friend of the owner had insisted on digging a hole in the field, which, though covered with a flag on which a substantial coating of clay had been well trodden down, was unaccountably found after a time to contain water; and it was difficult to say why water shouldn't find its way into a drain as well as into a hole. So a few acres were to be tried, as the cost would not be great, for everybody knew that it was of no use to drain clay deep, and inch pipes would be quite sufficient to carry off all the water there would be. In order, however, effectually to stop the mouths of all objectors, a small portion was to be done 4 feet deep. The lands were 18 feet wide, so a few drains were put in at a depth of 4 feet up every alternate furrow, and the remainder up each furrow at 2 feet deep. Both did good at first, but where the drains were in alternate furrows, and therefore 12 yards apart, the intermediate furrows held water all the winter. The shallow drains were the first to show symptoms of failure, and after a year or two deteriorated rapidly. In a few more years even the deep drains became less efficient, and the triumph of the anti-drainers was complete.

But the farm was now in possession of a man who was never satisfied until he could ascertain the cause of failure, and he saw at a glance that the deep drains were too wide apart. The slowness with which water percolates through really strong clay is such that wide drains cannot in ordinary seasons remove the surplus water of one rainfall before another comes. He therefore resolved to drain this land at six yards' interval, and as the cost of deep drains at this width would be heavy, he determined to put his tiles 3 feet deep, considering a bed of dry soil of that depth sufficient for any of our ordinary crops. On examining the old drains to ascertain the cause of their deterioration and inefficiency, he found that though in general well laid, there were places where the ends of adjoining tiles were not exactly on the same level or in the same line of direction, either in consequence of a little carelessness in the filling in, the occurrence of a large stone which it would have been laborious to remove or work round, or the removal of a smaller stone whose bed had not been sufficiently solidly filled up. In these cases the narrow channel afforded by inch pipes was sufficiently interrupted to check the



flow of the water, and cause a deposit of silt, which eventually became cemented by a ferruginous deposit, and permanently reduced the effective width of the pipe. In the shallow drains these results were much aggravated by their nearness to the surface. A short drought was sufficient to open wide fissures down to the tiles, and the first heavy shower washed so much fine soil into the drains between the joints of the tiles that the run of water was unable to remove the deposit, and the action of the drains from that time became more and more feeble and ineffective.

There were two modes of avoiding these evils, viz., the use of collars or of larger pipes. He found that 2-inch pipes could be obtained at little more cost than inch pipes and collars, and after duly balancing their respective merits, the tendency of drainage-water on clay land to form a hard ochreous deposit, decided him in favour of the wider conduit, using collars only where a piece of boggy ground or running sand made it necessary to take additional precautions against silting-up. In such places it was found to be desirable to use long collars, making them overlap more or less, according to the urgency of the case.

Whilst planning his drainage operations, our farmer was not content to have his ideas bounded by what he saw on the surface, but followed with his mental vision the great ramification of roots upon which all plants depend for their stability and nourishment. He considered the description of materials collected in Nature's great laboratory, the decaying vegetation, the decomposing manure, and the various combinations of mineral elements. He knew that if a supply of water were long withheld, all the elaborate subterranean machinery would be brought to a stand; and on the other hand, that if water were always present, new and injurious combinations would take the place of the natural and healthy cookery for which the apparatus was designed. But when once the stagnant water was removed from below, then each successive shower would distribute to the greedy rootlets their ready-formed food, at the same time that it *prepared more* by bringing together the elements of nutrition which lay around, only waiting for this connecting link in order to work afresh at the task of elaborating the supply of materials for the growth of the leaves and stems above. Nor was this all—stagnant air is as bad as stagnant water, and the frequent descent of rain through the soil is required to displace from its pores the vitiated air, to be quickly renewed by a supply fresh from the atmosphere, which is as necessary for the healthy underground growth of vegetation as for the proper action of the lungs of animals. Arrangements were therefore made for the thorough drainage of the farm, on the principle that it was an object worthy of the utmost skill of the husbandman to secure as much

as possible the sinking of the rain into the land *as it fell* and *where it fell*.

The next step was to form some plan for stocking and cropping the land. Previous experience as an occupier of strong land enabled the tenant to lay down certain maxims or axioms which he proposed to take as his guides. He had convinced himself, 1st, that corn-growing alone would not pay at present prices. 2nd. That the breeding and fattening of sheep had for many years been more profitable than any other branch of farming; and that although this was clearly not a sheep-farm, still, with proper arrangements, it might be made to carry a moderate number of sheep with advantage both to the pocket of the occupier and the condition of the land. 3rd. That horse-keep is the item which it is most difficult to *keep down* on clay farms, and which, if not resolutely dealt with, will effectually *keep down* the farmer's profits.

The plan now adopted was to buy in a sufficient number of ewes in the autumn to run on the old grass land through the winter, at the rate of about one to the acre. In ordinary seasons, they maintained themselves without extra keep until Christmas, from which time they received a small feed of oats daily until lambing time. After lambing, turnips or mangold, previously stored on the grass, were given them, with corn or cake, until the winter tares or clover were ready to commence. By the time these were consumed rape was ready, and by selling off the lambs fat from time to time, and continuing the allowance of corn or cake to the ewes, all the lambs and most of the ewes were sold fat to the butcher by the time the rape was done and the land had to be ploughed for wheat. This plan had the advantage not only of realizing in a short time a handsome profit from the sheep, but of leaving the clover, tare, and rape land in first-rate condition for a crop of wheat. It also promoted the great object of spreading the horse-labour more uniformly over the year, as the land was broken up as the green crop was consumed, and the press of work avoided which usually occurs at the time of wheat-sowing. It thus became practicable to employ the whole team immediately after harvest in preparing the land for swedes and mangold-wurzel, the acreage under root-crop being reduced to a minimum by the growth of green crops for summer consumption. The following was the method followed:—As soon as the corn was out of the field, the stubble was scarified or breast-ploughed so lightly as to make sure of being able to burn in small heaps all that was pared off. After spreading the ashes, 12 loads per acre of manure fresh from the yards were distributed evenly over the surface, and ploughed in with a good deep furrow, of such a width as to stand nearly or quite on edge. Thus it remained fully exposed

to the weather during the whole winter ; and as soon as dry weather set in in spring, a turn or two of the harrows, followed by a light grubber, destroyed the annual weeds, and the land was ready for sowing. Four cwt. of guano per acre sown broadcast and harrowed in with the seed, which was drilled on the flat at three feet between the rows, completed the operation. The tilth thus produced was superior to that obtained in any other way on strong clay ; and though the land had only been winter-fallowed, any want of mellowness was made good during the early summer by frequent and thorough horse-hoeing, first shallow and then deeper, as more and more mould was formed. The advantages obtained by this system of growing roots were numerous :— 1st. By securing an early seed-time, so that the crop was sufficiently mature to be removed from the land in October for storage at the homestead or on the grass for ewes and lambs in the spring. 2nd. By carting the manure on the land early in autumn, before the solidity produced by the drought of summer had been lost. 3rd. By the great economy of horse-labour in growing a fallow crop with only one ploughing, leaving the rest of the rough work to be done by the powerful though wayward team, *frost, snow, wind, and rain.*

Good crops of both swedes and mangold wurzel were grown in this way, at moderate cost ; the only difference in cultivation being that the swedes were sown a month later, and that instead of 4 cwt. of guano per acre 2 cwt. of guano and 2 cwt. of superphosphate were sown broadcast at the time of sowing. But the heavy expense of carting a whole root-crop from the land prevented the tenant from growing any considerable acreage of either ; his great object being to introduce as much as possible into the management of clay-land that characteristic feature of light-land farming which constitutes the great difference between them in point of profit, viz., *manuring the land by sheep instead of the dungcart.*

The management of the corn on this farm soon became the topic of conversation. From an average yield of two to three quarters per acre the wheat-crop soon rose to four and even five, and the spring-corn improved in proportion. Yet, when asked what he did to his corn, the farmer said, “ *Nothing ! but hoe it ;* ” and when pressed on the subject of manure his invariable answer was, “ *If you take care of your land, the corn will take care of itself.* ” These seemed but simple answers, but they meant much. The consumption of green crops on the land in summer has already been described ; the improvements he introduced into the making and keeping of his manure have yet to be told. The two together evinced that care for his land, of which he spoke so oracularly, and which produced him such a bountiful return at the time of harvest. But



he set great store by his hoeing. In a dry spring, when wheat carried a splendid colour on good land, it used to turn yellow and sickly on this strong clay, even where well drained; and our farmer said it was all from want of hoeing. He explained it thus: if land is in good condition, and free from stagnant water, the roots of the wheat-plant will grow all through winter, and will extend over a considerable surface by the time when dry weather usually sets in. As soon as clay begins to dry it begins to crack, and the fissures are wide enough entirely to break off the small roots and sever the plant from a large portion of its supply of food. Hence its change of colour and loss of vigour during the dry weather, which is on all other grounds favourable to its healthy development. This can only be prevented by horse-hoeing, not a single shallow hoeing, or rather sliding over the surface, which only shaves off a few annual weeds, but hoeings repeated until a good covering of mould can be obtained. When he had accomplished this, he used to boast that his clay would carry the wheat up to harvest better than any light land in the country.

The arrangements for stocking and managing the grass-land on this farm were worthy of attention. It contained a good deal of inferior pasture, but no grass good enough to fatten a bullock; and the previous plan had been to buy in young cattle in the spring, when most other graziers were doing the same, and when consequently in nine years out of ten they were bought dear. They had to be sold out again in the autumn, when many other farmers were selling too; so that the tenant generally returned from the fair grumbling that he had scarcely got more than he gave for his stock, and that his summer's grass was all but thrown away. The difficulty on this land was that cattle could not be fattened at grass; and, if made up in winter, they either required more turnips than it was profitable to grow on such a farm, or, if fed solely on corn and cake, it was difficult to make them pay their way. The new tenant's first attempt was to give his bullocks cake at grass, but some of them would not eat it; and even with this assistance the grass was not good enough for the purpose, and the cost was considerable. He therefore tried another plan, which turned out a complete success. He bought yearling heifers in May, and a young bull to run with them at grass. The bull was taken from them in August, so that none should calve later than May. The heifers remained in these pastures until severe weather set in, when they were taken into the strawyard, and received once a day a feed of roots, if there were any to spare; if not, 2 lbs. of linseed-cake daily, which, at 12*l.* per ton, cost 1*s.* 6*d.* per week. If in-calf heifers were very dear in the spring, he occasionally sold a few just before calving,



for as much money as if they were prime fat; but his usual course was to let the calves run with their dams all the summer. When taken up in October they were so fat and their points so well developed that they looked like prize beasts in miniature; and by keeping them well through the winter and spring they were eagerly bought by the butchers in June, when the winter-fed cattle had been nearly all slaughtered and the grass-fed had not yet come in. The heifers were disposed of as follows: a few that promised to be first-rate milkers were taken into the dairy; the greater part were sold for winter-feeding, and from their age and growth were worth about 2*l.* more than when bought in a year and a half before. The value of two summers' grass for a young heifer on pasture of this quality was rated at 4*l.*; linseed-cake for twenty weeks, at 1*s.* 6*d.* = 1*l.* 10*s.*; so that the heifer when sold had cost about 5*l.* 10*s.*, from which, if her increased value be deducted, 3*l.* 10*s.* would be left as the cost of the calf. These calves received as much cake as they would eat, which did not exceed 1*lb.* per day at first, and 3*lbs.* at the latter end of the time, averaging 2*lbs.* per day, at a cost of 1*s.* 6*d.* per week, or for the thirty-four weeks 2*l.* 11*s.* per head. Taking an average consumption of 2 stone of roots per day, for thirty-four weeks, each calf would consume 3 tons of roots, which, at 7*s.* per ton = 1*l.* 1*s.* These items, added to the keep of the heifer, made a total cost of 7*l.* 2*s.* each. The straw and attendance were considered to be well paid for by the manure.

The price at which these yearlings sold varied of course with the markets; but in consequence of their first-rate quality, and their light weights, which exactly suited the butchers during the hot weather, they were always worth 1*s.* per stone more than the average price of fat beef; and they generally fetched 1*l.* per month of their age, varying from 12*l.* to 16*l.* per head: one year the whole lot averaged 16*l.* each, their age being fourteen months. In all cases they left a handsome profit. The peculiar advantages of this system were thus described by the tenant. He said that when he took his half-fat cattle to market, he had to run after his customers; now they ran after him. Besides, it suited him better to feed cattle that ate 2*lbs.* of cake per day than those that ate six: he always fancied that the big beasts ate *not only their share of the cake, but his too*. As to the meadow-land, the present occupier made a point of mowing as small a number of acres as possible; but in order to keep the acreage *down*, he said it was necessary to keep the condition *up*; and as the field of clover which had formerly been mown for winter fodder for the horses was now given up to the sheep, it was necessary either to mow more of the grass, or to put up with a smaller stack of hay, unless the land could be made to produce more per acre. This

the tenant did not think a very difficult task, when he was told that the usual yield from 20 acres of meadow was about 15 tons of hay. He saw that the land required liberal treatment for some years; and he therefore dressed it the first season with 2 cwt. of guano and 1 cwt. of nitrate of soda per acre, following it up the next year by a heavy dressing of well-made manure. He also took care that the land should be cleared by the 1st of March, as he had often seen a crop of hay ruined from the meadow being eaten bare in April. If drought sets in in May, land so treated becomes parched for want of its natural covering, and the grass receives so severe a check that it recovers very slowly; and if the season continues dry, the ultimate result is half a crop of hay, stacked some weeks later than usual, and no after-grass. After two years of the treatment above mentioned, the clovers and finer grasses sprang up so as completely to change the character of the herbage in these meadows. They also produced half a ton more hay per acre.

The last point to be noticed in the management of this farm is the treatment of the manure. In consideration of the spirited exertions of the new tenant, his landlord consented to roof over a small fold-yard as an experiment; and the manure thus made was tested against an equal quantity made in the ordinary way. The result was so decidedly in favour of the former, that after some years' experience the tenant declared that he would rather pay for covering the yard himself than be deprived of the benefit derived from it. The cost of the roof was about 5s. per superficial yard of the space covered; and the increased value of the manure was found to be from 25 to 30 per cent. The advantage, however, did not end there, as there was considerable saving of expense by not carting the manure into heaps, or turning it once or twice in the heap, as had been the previous custom. It remained in the yard undisturbed until wanted, and was then in first-rate order for carting on to the land, whether applied to the grass or for a fallow crop.

The time of publication has arrived, and the writer greatly regrets that he is unable to complete his programme. There are subjects of great interest, intimately connected with agricultural progress, which have been wholly untouched. Amongst others may be named—the *latest improvements in the management of light land*, especially by *claying or marling*—*farm-buildings*—*labourers' cottages*, and the *connection of railways with agricultural development*. To all these subjects he has devoted a good deal of attention, and on each of them he was desirous of writing a few pages in this Journal. The great difficulty, however, of collecting any authentic statistics relating to agriculture, has caused months to be spent where apparently weeks should have

sufficed; and all that is now possible is to "report progress," and ask leave to write again in order to complete the plan originally chalked out. He would fain hope, however, that sufficient has been done to show that the improvements introduced into farming practice within the last twenty-five years are greater than in any similar period on record. It is true that direct proof is rarely to be had; there are no data in existence which make it possible to state the ultimate result of these improvements in bushels of corn or tons of meat; but the chain of circumstantial evidence is so complete that no reasonable doubt can be entertained of the fact that, since 1839, a very large addition has been made to the food of both man and beast in these islands.

The most striking feature, however, of the period on which we have been engaged, which both gives a satisfactory aspect to the past, and warrants the most cheering anticipations for the future, is the improvement which has been effected in the position of the agriculturist, whether measured by the extent of his material resources or by the soundness and variety of the knowledge at his command. What was his position at the commencement of the period? It is scarcely an exaggeration to say that the thoroughbred British farmer of that day despised science as much as he feared Free-trade, and that the only things which commanded his entire confidence were his father's experience and his own skill. Mr. Pusey was undoubtedly far in advance of his generation when he adopted the motto, "Practice with Science," and even he considered it rather as an expression of what was *desirable* than of what was *probable*. The first attempts of the farmer and the philosopher to run in couples were certainly not encouraging. They conversed with one another in unknown tongues, and many of the early specimens of scientific practice, such as irrigation with the drainage from farmyards, artificial silicates to stiffen straw, &c. &c., were decided failures.

The Schoolmaster, however, was abroad; and farmers' sons, in common with those of all other classes, received a better education. It was considered necessary to teach them, at any rate, the alphabet of science. Scientific men were also found, who were willing to devote their time to agricultural investigations, and they saw the necessity for making themselves acquainted with the rudiments of practice, so that the votaries of science and of practice began to understand each other better, and their mutual distrust gradually wore off.

The difficulties attendant on the introduction of Free-trade have also been happily surmounted. That great change in our fiscal policy caused such a sudden influx of the agricultural products of other countries that prices were ruinously depressed, until the natural, but more tardy, effects of the change were shown



in an unparalleled expansion of trade and consequent increase of wealth and of effective demand for farm-produce.

Hence the quarter century just ending has seen agriculture relieved of its greatest cause of uncertainty and alarm, and restored to its natural and unassailable position. It leaves the agriculturist better educated, and therefore more willing to be taught and more able to learn. It leaves him in possession of resources whether of machinery, manures, or means of locomotion, far in advance of the wildest dreams of his forefathers. It can, therefore, close its career with a satisfactory account of its stewardship; seeing that it hands over agriculture to its successor free from all restrictions, with a demand for its products which has never been equalled, with the gigantic power of steam entirely under its control, and with the growing intelligence of the agriculturist just awakening to the consciousness of the boundless region of scientific improvement which lies invitingly within reach.

*Kirby Hall, 1863-4.*

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## II.—*Hop Cultivation.* By JOHN P. SMITH.

### A WORCESTER PRIZE ESSAY.

THE hop thrives best in moderately warm climates, and this may account for Kent and Sussex, two of the most southerly counties, being selected for its cultivation, and producing a very large proportion of the annual yield of the kingdom. Worcester and Hereford stand next in importance, and yield about one-eleventh of the yearly average growth. Farnham and its neighbourhood stand next as to quantity. The district known as the North Clays, in Nottinghamshire, formerly grew a fair quantity of good hops, but of late years the plantations have been much reduced; the same remark applies to the district around Stow Market in Suffolk, and also to the county of Essex.

A south-eastern aspect affords, in my opinion, the best situation for a hop garden, and if it be well protected from the west winds that prevail during the autumn, so much the better, as great mischief is often done by wind. Due care must be taken to adapt the planting to the peculiarities of the soil. The Golding hop will be found to succeed best on dry friable soil, with a gravelly or rocky subsoil, such as we find in the hilly districts of Middle and East Kent, whilst Mathon White, and Grapes, prefer a stronger soil, approaching to clay; the former variety flourishes on the deep land in the vale of the Teme, and the latter in the Weald of Kent and Sussex, which is



mostly strong clay soil. Another variety, Cooper's White, a good sort, but delicate, is best suited for good strong *loam*. There are besides several kinds of red hops that are not approved by the brewer, and, in my opinion, cannot too soon become extinct; they are mostly grown on the poor lands of Herefordshire. Many other kinds are grown in Kent and Sussex, viz., Golden Tips, Pheasants, Golden Grapes, White Bines, Grapes, Jones's, &c., and a sort introduced some few years since by Mr. Colegate, and known by his name. This is a hardy variety and heavy cropper, but subject to blight, and repudiated by the brewer as a rank bad hop, yielding a most unpleasant flavour to the beer. A young planter should avoid this variety if he wishes to obtain a good character for his growth.

We will now assume that a suitable field—one that has been thoroughly drained—has been selected, and the preference given to an old piece of turf; in that case I would recommend that the land be trenched two spits deep, the top spit being kept uppermost, with the turf downwards. When the digging is finished, the surface should be harrowed, and rolled down as fine and level as possible, ready for setting out. The planter must next determine on the arrangement of the rows, whether on the angle or the square, and the distance from plant to plant. The usual method in Worcestershire and Herefordshire is to lay out the rows 7 or 8 feet apart, and set the plants  $2\frac{1}{2}$  to 3 feet distant in the rows. If your land be good, and likely to be highly farmed, an uniform distance of 7 feet square may be recommended; good cultivation will ensure a large quantity of bine, and a sufficient quantity of sun to bring the fruit to perfection, whilst at this distance you have more room to cultivate without injuring the bines.

If this plan is adopted, you must prepare 889 small sticks, a foot to 18 inches long, for every acre, that being the number of hills which an acre will take at 7 feet square. First square your field, and then commence in the centre, working right and left; you will thus be more likely to be correct than if you begin on one side.

Your field being truly set out, you may prepare for planting; if you plant bedded or yearling sets (which are far preferable to cuttings), a man should take a spade, and remove the soil from two sides of the stick, the opening being 2 inches wide at the top, and 4 to 5 inches at the bottom, which should be deep enough to let the roots lie straight. Two strong-bedded roots are sufficient for a hill, but if not strong, 3 may be better. Care should be taken to bring the head of each root as close to the stick as possible, some good fine soil should then be put to the roots, and made firm with

the foot. For a plantation of 20 acres, with suitable oasts and cooling rooms to dry and cool the crop in one month, for a first-class growth, the following varieties are recommended:—5 acres of Cooper's White, or 3 Coopers and 2 Jones's; 6 acres Mathons; 6 or 7 acres of Goldings, and 2 or 3 Grapes; but this distribution of sorts must, in a measure, be governed by the quality of the land, that variety being most largely planted which is best suited to the soil. The crop ought to be secured in three weeks, or certainly not more than a month; and it is most important to have an early sort, such as Cooper's White or Jones's, to commence with, then will follow your Mathons, then the Goldings, and lastly, the Grapes, a hardy sort, which will hang well for the last picking. Jones's are serviceable to use up old poles. The writer has seen a ton an acre on 7-foot poles. If, as is mostly the case in Sussex, one variety only be planted, you must begin to pick before your hops are ripe, or have a considerable proportion brown before you can finish.

If the planter should determine on a piece of old tillage, I recommend him to plough 10 inches, and subsoil as deep as he can; the ploughing completed, he will proceed the same as if it had been a meadow, with this exception, that after the sticks are truly set, he should dig holes 2 feet in diameter, and 2 feet deep, placing the top or best soil on one side, and the bottom soil on the other side of the hole obliquely, so that the heaps may not interfere with replacing the sticks when the holes are refilled. Good dung or rather a rich compost should be wheeled on, and a fork or shovelful mixed with the *best soil* after the hole has been half filled with good soil from the surface; this being finished, you must readjust your sticks, and when your soil has had time to settle, you may proceed to plant in the manner before described. On no account bury your manure. Should the weather be favourable, and your roots get a start, they will require two poles to each hill 6 to 7 feet long, and if the season be good, a crop of 2 or 3 cwt. an acre may be grown; if cuttings are planted you lose a year.

Potatoes and mangold are frequently planted between the rows, and an ox-cabbage between each hill; this will, by many, be condemned, but much depends on the condition of the land and the disposition of the planter to make compensation to the soil for what has been taken out by the green crops by a dressing of manure, which must be applied in the winter and dug in. Turnips may be planted if the land admits of their being fed off; and this plan, if oil-cake or corn be given, will manure the land at a cheap rate, greatly to the benefit of the hops.

February and March are the months best suited for throwing down and cutting, the land being first ploughed or dug. If the

plough is used, a slip from 12 to 15 inches wide is left. Your men will commence digging these slips, cleaning the hills, and cutting the roots: this finished, your poles must be spread, and your pile rows ploughed, dug, and cut the same as the rest.

In the course of a fortnight or three weeks the bines will begin to appear, when no time should be lost in pitching the poles, which should be set by line to ensure regularity: the poles for this season, if the roots are strong, may be from 10 to 12 feet. The next operation is tying, but the tyer should first go over and take out the rank hollow bines; these should, on no account, be put up the poles, since they have a tendency to grow to an extravagant quantity of bine, without bearing a proportionate quantity of fruit—the next and less vigorous bines will be found far more fruitful. Some planters put three bines up each pole: if four poles are put to a hill, which is the custom at 7 feet square, two bines will be found sufficient; if three poles, put two twos and a three. The writer has often seen a heavy produce from a single bine. The tyers are paid by the acre, and go over the hills three or four times until the poles are furnished, when all superfluous bines and weeds are pulled out. This completes the tying, except by ladder, which is paid for extra. The men now follow, dig round the hills, and put a shovelful of soil into each hill—this prevents new bines from springing up.

Different varieties require different sized poles. On no account overpole, as much injury has resulted from it; 14-foot poles are long enough for any variety except Goldings, and for them I would not, as a rule, exceed 15 feet. Jones's will do well with 8 feet; Grapes 10 to 12; Coopers 12, and Mathons 12 to 14 feet, according to cultivation and quality of land. When your hops are tied, no time should be lost in working them with the nidget or scuffle, followed by the harrow—this should be done both ways. All working should be finished by the 1st of July, certainly by the 10th; considerable mischief is often done by working too late, unless in years of blight. When you have vermin on your bines, do nothing to your land—leave them until the vermin disappears—then go in with all your strength, nidgett both ways, and do all you can to put fresh vigour into the plant. Some planters manure in the winter, and some both winter and summer; but this may be carried too far for quality, and produce mould. The plan adopted in summer is to wheel in good dung or compost, take the soil from round the hills, put in the manure, and dig it in; or spread the compost (which I prefer) round the hills on the surface and dig in. All that is necessary after is to use your nidget, and harrow both ways, taking care not to pull up the dung. This should complete the work, unless hoeing is required to keep down annuals.

Picking commences in early seasons from the 1st to the 8th September; in late ones, from the 15th to the 20th. Before it begins due provision should be made, and everything got in readiness: cokes may be sent for in July and August, and a sufficient number of pickers engaged to keep your kilns or oasts properly at work. In this you must be governed by the size of the hops. Different plans are adopted in picking and measuring; some measure by tally, others by book and cards representing the number of each crib or bin. I have found it best to put two cribs into the centre of 100 hills; this is called a "house," and the cribs remain until the work is finished. The poles will be in two heaps at either end of the cribs, and in the proper place for stripping and piling. If this is strictly carried out, much trouble is saved in piling the poles. When a sufficient number of sacks are picked to load one kiln (and this should be done before breakfast), they should be taken and put on the oast, and so on until all your kilns or oasts are loaded; and it should be so managed that hops enough be picked to reload the kilns at night.

Hop-drying requires great attention, and the *slower*, in reason, they are dried, the better. They should be dried by a current of hot air being continuously passed through them, and not by combustion. Many say they can dry hops in seven or eight hours; rely on it, it is better to take twelve, and let your heat not exceed 112 to 115 degrees. When the hops are sufficiently dried, the fire should be raked or allowed to go down, the hops remaining on the kiln until they become soft, which will prevent their breaking on being removed to the cooling-room. These hops will be fit to be bagged the next day, and with a proper staff this should be carried out through the picking.

Poles are a heavy item in the cost of hop-cultivation, and should be carefully husbanded. Their wearing value may be *doubled* by pickling  $2\frac{1}{2}$  feet at the sharpened end with creosote. A tank for the purpose must be erected of size in proportion to the plantation. By the application of creosote, soft wood, such as that of the willow, &c., becomes hardened, and equal to ash or other more durable sorts.

The writer has a plantation of 75 acres, and a tank 12 feet long by 5 wide, and  $3\frac{1}{2}$  feet deep. This tank will hold 1000 best poles put to stand up. The tank must be filled with creosote within 8 inches of the top when the poles are in, when water fully 2 inches deep must be added to prevent evaporation. The tank should boil slowly twenty-four hours, when the poles may be removed and the tank refilled. Care must be taken that the tank does not boil over, as creosote is most inflammable and may take fire. I am so satisfied as to the value of creosoting poles



that I never intend to put a new pole into my ground without its aid. If poles were pickled one year under another, and stored in a stack till dry, they would be found to last far longer than if used in a green state.

The hop-plant has a variety of enemies: on the first appearance of the bine it is frequently attacked by *flea*, which checks its growth, and makes it look scrubby and unhealthy, but never destroys the crop. Wireworms are a great pest; the best plan to get rid of them is to cut a potato in half, and place it close on either side the root an inch below the surface; the potato lures the worm, and, if taken up every other morning for a fortnight, enables you to take a great quantity; I have known of a dozen being taken from one root. The greatest enemy is the *aphis*, and I regret to say that on the most important subject of its history we are as ignorant as our forefathers; we go to bed leaving our garden free, and next morning we find *aphis*—from one to ten or twenty—on a small leaf, which in the course of a week have increased to countless myriads. These pests are followed by nits and lice, which some seasons multiply so rapidly as to destroy the bine and the planter's prospects. I would here repeat the recommendation which I have already given to the planter, not to work his hops when in a state of blight. When closely watching the blights of 1860, '61, and '62, I have observed that in all cases where the land was best tilled, manured, and cared for, the blight remained until too late in the season for the chance of a crop; on the other hand, where nothing was done, but weeds were suffered to grow nearly half-way up the poles, the bine became yellow and clean, and the result was a fair sprinkling of hops; in such ground, the vermin had left the hop for want of sap and taken to the weeds.

Of late years a machine has been used to pack the hops, which is very useful when there is a large crop, as it enables you to pack your hops much sooner. Treading up is preferable, if care be taken to have the hops in a fit state not to break under the foot; if allowed to become *too* cool they are hard and lumpy in the sample, and are termed *cold*. A master's attention to the state of his hops before bagging is most necessary to good management. Hops are picked in Worcestershire and Herefordshire far more free from leaves than in Kent or Sussex. They should be sent, if possible, to the oast without a leaf, dried slowly, taken off the kiln in a *soft*, *not* a brittle state, and trod into the pocket as soon as sufficiently cool; they do not then break under the foot. In Kent and Sussex hops are dried in a variety of ways, and with several kinds of fuel. In oasts on the Cockle principle anything may be used, and a considerable quantity of sulphur is required; but on the open fire principle Welsh coal and coke is used, and a small quantity of sulphur.

The cokes we get from Abberley and Pensax, in Worcestershire, are highly charged with sulphur, which will account for so little being added in these counties. Its only value is to give brilliancy to the sample, and, if used in excess, brewers object to it as affecting the fermentation of their worts.

It has been the practice in Worcestershire and Herefordshire to make eight sacks out of one piece of cloth of 36 yards, and the weight of the pockets when filled run from 1 cwt. 1 qr. to 1 cwt. 2 qrs. It is my practice to make seven sacks from a piece, and I am thereby enabled to get 1 cwt. 2 qrs. to 1 cwt. 3 qrs. into a pocket, and I would respectfully recommend my brother-planters to do the same. A heavy pocket has many advantages over a light one; you pay less for weighing, portorage, and warehouse rent, and you get your hops more quickly into consumption.

It was formerly the practice to roll, riddle, and otherwise break and spoil good hops; this silly practice is in a great measure exploded. Plant the best sorts, such as Coopers, Mathons, and Goldings; pick them clean, dry them properly, and put them into the pockets as whole as possible. By breaking the hop you lose a large quantity of the pollen, which contains *the most valuable brewing properties*.

The cost of hop cultivation per acre may be estimated as follows:—

	£.	s.	d.
Yearly charge for poles .. .. .	5	0	0
Ploughing down .. .. .	0	10	0
Digging slips (or portion not ploughed) .. .. .	0	5	0
Cutting, picking up, and burying roots .. .. .	0	4	0
Spreading poles .. .. .	0	2	0
Pitching or setting poles .. .. .	0	12	0
Tying .. .. .	0	8	0
Nidgetting or scuffling 4 times .. .. .	1	0	0
Harrowing 4 times .. .. .	0	6	0
Forking round hills and hilling up .. .. .	0	5	0
Stripping and piling poles .. .. .	0	8	0
Resharpening broken poles .. .. .	0	3	0
Ploughing up before winter .. .. .	0	10	0
Manuring, if with dung, 20 loads per acre, at 8s. .. .. .	8	0	0
If manured in summer .. .. .	4	0	0
Ladder tying .. .. .	0	2	0
	21	15	0
If you dig instead of plough, 15s. per acre extra .. .. .	0	15	0
Total .. .. .	22	10	0

*Lower Wick, Worcester.*

III.—*On Education as connected with Agriculture.* By the Rev. J. L. BRERETON, Rector of West Buckland, Devon, and Prebendary of Exeter Cathedral.

THE subject of education has not hitherto been very popular with farmers, and seldom forms a topic of discussion at their meetings or in their journals. This has arisen partly from their instinctive feeling that education is a matter of books and study, while farming is a matter of life and practice, and that these are contrary the one to the other; but partly also is it due to the fact that education is a social question, and that no class of men are so sensitive on such matters as those who belong neither to the higher nor the lower, but to the intermediate ranks of society. But though good reasons may be given for avoiding the discussion, there are reasons even more urgent and practical for entering upon it. On the one hand, farming is becoming, not indeed less a matter of practice, but more than ever a matter of study; and on the other, social questions are forced by the progress and pressure of society into a prominence which may be contrary to our tastes, but which neither duty nor interest can neglect. The time has come when the consideration of education as connected with agriculture will not be considered intrusive even in the special province of an agricultural journal.

And whereas agriculture more than any other pursuit distributes its followers into three distinct grades—the owners, the occupiers, the labourers, of the land—so does this distribution into a higher, middle, and lower class, form the most convenient basis for the treatment of the subject of education. By this threefold division it can best be mastered as an interesting matter of thought, and still more practically discussed as an important field for public action. This threefold division of those through whom agriculture, as a special pursuit, becomes connected with education, as a general principle, will be the connecting thought of the following pages. But because so much has been done for the education of the higher and of the lower classes, and so much avowedly remains to be done for those who come between, the inquiries and suggestions I shall venture to make will have a special reference to the farmers, as forming a large and most important section of the English middle class.

There are two questions which must have often occurred to those whose tastes or pursuits will have made them readers of an agricultural journal. One is, “What is the best education for a farmer?” The other, “What is the best education for a farmer’s

son?" And though these questions are respectively suggested by different circumstances, yet they are sufficiently related to admit of discussion in the same paper.

Farmers are not necessarily or in fact all the sons of farmers, still less are all the sons of farmers intended to be farmers. "The best education for a farmer" presupposes nothing as to the class of life from which a pupil comes. "The best education for a farmer's son" assumes nothing as to his ultimate destination. In the former case, the end absolutely decides the means to be employed: in the latter the means may limit, but do not control the selection of ends.

It would, therefore, be quite possible to discuss either of these questions without reference to the other. And either would of itself deserve the attention of all who take an interest in agricultural life. But as the two subjects of general and special education, though distinct, have yet a mutual interdependence and can best be considered simultaneously, I will ask my readers to bear them both in mind.

In order to do so the more easily, let them bring to their minds the common case of a farmer with a large family, who desires one at least of his sons to follow his own pursuits, others to adopt some of the various openings of life to which education furnishes the approach. Only let it be remembered that as the English farmer represents one of the largest sections of our national society—in some places touching, by his share in actual labour, the operative class, in others joining and gladly welcomed among the honourable company of gentlemen—so the education of a farmer's son admits of a wide latitude of standard. If, however, we assume as an average English farmer, or at least as a specimen sufficiently illustrative for our purpose, one who occupies with sufficient capital from 300 to 500 acres, and who would wish his sons to earn incomes not under 100*l.* a year, we may I think roughly estimate the cost of the education that would suit such a parent's requirements.

We may consider the question of the relative advantages and faults of *public* and *private* education to have been sufficiently solved by the experience of the higher classes. Their verdict has unmistakeably been in favour of public education as the rule, allowing great exceptional value to private education in particular cases, and as preparatory or supplementary to the public schools. The broad difference between a public and private school is that the former is not, but the latter is the property of the master who conducts it. A purely public school is one the whole property of which is entrusted to disinterested guardians, with or without local and personal preference and limitations. But between this



and a private school, the property of its master, there are intermediate schools, partly public and partly private. They are the property neither of the masters who conduct them, nor of trustees, but of proprietors who have established them, either as commercial enterprises or for the benefit of certain localities, professions, or occupations. In these the public or the private character may preponderate. The views of the original proprietors, the restrictions they may by trust or otherwise impose upon the conduct of their institution, the realization of immediate or more remote advantages, will all go to determine whether they should be considered more as public or as private establishments.

This rough classification of schools into public, private, and intermediate, will be of service to us in determining whether existing schools supply the practical requirements for the farmer's family, or whether new schools should be established, and, if so, what should be their character.

We may suppose then that, as in the higher ranks, so among the middle classes, the preference will be given to public schools, the more education is valued and its permanent interests considered. But the best of the foundation schools of the country are already more than filled by the sons of the gentry. Nor has it hitherto appeared easy to adapt those that are not thus monopolised by the candidates for the Universities and higher professions to the practical requirements of modern English education. This is not indeed to be despaired of, and the 500 endowed grammar-schools of England may yet have a great future. But their reformation and revival will follow, I think, rather than precede the establishment of a thorough system of public English education, which, imitating that of which the English gentry are so proud, and which has made their own country proud and other countries emulous of them, shall yet embrace and satisfy the far more numerous class connected with the commerce, manufacture, and agriculture of our country. Of the means of establishing such a system I shall presently say more. Here I can only repeat the opinion that the renewal or revivification of stagnant grammar-schools has seemed hitherto a more difficult task than the establishment of new institutions primarily devised for the objects and circumstances of the present generation. And since we live in an age more impatient for immediate results than prepared, like our forefathers, to sow the seed of a long-distant harvest, I am inclined to think that we should look to a large development of those proprietary schools which I have described as intermediate between the purely public and strictly private schools. Only from the very outset it will be no injury to the immediate results, but a provision for permanent effects, if every

effort is made avowedly and honestly to give a public and honourable rather than a merely private commercial character to such schools. The readiest means of doing so is to attach them by name, and, as possible, by constitution to some of the ancient fundamental institutions of the nation. Of these there are two that offer themselves at once for consideration—the Church and the State. The former has always been identified with the education of all classes: the latter has of late years assumed a large, indeed a preponderating share in the maintenance and direction of the education of the labourer, while it has only touched, but without affecting their general character, our old universities and public and grammar schools. But it needs not many sentences to show that though any public education in England must not only have a religious character, but be so in harmony with the broad principles of the Church of England as to ensure the cordial cooperation of its clergy and laity; yet an exclusive Church character would only shut out from its advantages a very large number of the middle class. Or again it may be easily shown that though Englishmen will expect their sons to be trained in the utmost loyalty to the Crown and obedience to constituted authority, yet the independent classes will expect their schools like their homes to be free alike from State support and Government inspection. There remains, I think, an alternative. The ancient organization of the English *counties* is sufficiently connected with all the best associations both of Church and State, yet sufficiently free from exclusive and arbitrary influences to offer a common name and many local centres round which the public education of the middle classes may be safely and honourably grouped.

Public proprietary schools, distributed through the various counties of England, and associated as much as possible with all the honourable and influential names and personages of these counties, are, I have long ventured to think, the first requisite towards improved agricultural education. Such schools will supply, not only to the future farmer but to all the farmer's sons that general groundwork of education which should precede and be the foundation of all sound knowledge and special practice. That such schools may be established at a moderate outlay of capital, and be conducted remuneratively at no very high charge to parents, is not only a reasonable assumption but an ascertained fact. I append to this paper an analysis of the cost of establishing the Devon County School, as well as of its annual expenditure. It will show that the cost of building a handsome school for 100 boarders, of furnishing it, of purchasing about ten acres of ground, of conducting it from its commencement with two pupils, about

five years ago, to its present development with some sixty boarders and fifteen day-boys, has been between 6000*l.* and 7000*l.*, and that a rate of payment averaging 23*l.* per boarder is found to cover the whole annual expenditure. In some counties the cost of building, the price of land, and the rate of wages may be so much higher as to raise the average cost of establishing such schools, and the average rate of payment necessary to make them self-supporting. But even higher sums would be very far from putting such schools out of the reach of the average English farmer.

What, then, would be the nature of the teaching and training the farmer's son should expect to find in these schools? and how far would they be suited equally to the son who is intended to be a farmer, and to his brothers who are to go into other trades and professions? These questions lead us to a farther step in our discussion. The character of the education given in a public school depends not only, as in a private school, on the acquirement and ability of the master at its head, but also on the general system of education according to which the master himself has been trained, and on the public competitive tests by which attainment is certified, and the merit both of the school and of individual pupils made known.

The education of the higher and lower ranks is regulated and maintained in each case by such a system. I will not do more than allude to the effect which, on the one hand, the Universities by their degrees and honours have upon the great public schools and subsidiary system of private tuition by which the majority of the English gentry are brought up; and, on the other, to the influence which the Government grant in aid of local contributions, as administered by the Privy Council, exercises upon the education of the lower class. This reference is not intended to imply any approval of the State grant, and still less to decide whether in principle or results, its action is worthy of comparison with the independent working of the University system, but simply as an illustration of the proposition, that both the teaching and discipline—that is, the education—of a public school must depend upon the system to which it belongs, and not only to the accidental merit of its master.

The comparative deficiencies of middle-class education may be attributed to the fact, that neither in the development during this century of the higher system, nor in the establishment of the lower, has there as yet been provision made for the large intermediate class who can neither aspire to the former nor condescend to the latter. There are indeed many advocates for so extending these two systems as to embrace all the upper middle class in the educational system of the gentry, and to absorb the



remainder in that formed by the help of the State for the labourer. It is also still an open question, though not likely long to be so, whether public opinion will acquiesce in the permanent establishment of those subsidiary examinations which the Universities have recently undertaken for the middle class, or whether it will adopt the proposal to establish, in connexion with the different counties, a new educational system with its own public schools, colleges, and university. In either case we may hope that a standard will be gradually fixed both for general knowledge and for special studies, which will remove the existing uncertainty of object and irregularity of method, which are equally injurious to the teacher and the taught, to the school and the home.

The effects which such a definite standard would have upon the English farmer's family can hardly be overrated. When once it becomes recognised as the rule, that all the sons of the family should complete their education by obtaining a degree, the habits of the household would be regulated accordingly; and the mere necessary arrangements for study would open in the seclusion and frequent leisure of the farmer's home prospects of domestic order and happiness hitherto almost unknown. Such an object alone, without reference to the means of its attainment, would insure this. For equally the holidays of the schoolboy, the vacation of the collegian, or the daily pursuits of the home-student would have this effect, which would also extend indirectly to the female members of the family. I have long considered that such a degree, whether conferred by the present Universities, or as resulting from the successful establishment of a new county system, was the first requisite for raising the tone of the middle classes.

Its primary object, however, would not be to affect them in their homes, but to fit them for leaving the parent hearth and entering upon the world. Those who had obtained it would have a passport to educated society; and whatever their special profession or occupation, would be entitled to the freer intercourse with members of other professions and pursuits, which is among the most valuable of the social and intellectual privileges that a man can possess. Such an acquisition would have the happy effect of making the future farmer more at his ease with both the gentry and the labourers; because a man who has attained an honourable status, which others recognise as well as himself, is set free from many embarrassments which await any one whose education is doubtful and position undefined.

Though I have no pretensions to write on purely agricultural subjects, I cannot forbear to point out the importance, merely with a view to agricultural progress, of increasing the farmer's



confidence in his own position, as meriting respect and consideration whether from his landlord, his labourer, or his neighbours. I do not say that an educational degree alone would give this advantage where it is not combined with personal character, with respectability of connexion, and with sufficient capital for the position the man holds. But how often are one or other of these qualifications, when exclusively relied on, mere sources of pride and offence, of vanity and vexation, because the man himself, his family, or his purse have to sustain a disproportionate strain owing to one fatal defect, "under-education."

But I must not think or write only of the social advantages of an educational degree. That degree should imply a thorough knowledge of the English and at least one other language, with a tolerably high standard of mathematical knowledge, besides history and geography. How many excellent men have now to regret the want of these attainments, not only as debarring them from much of the best social intercourse, but as actually hindering them in their business or profession! Any difficulty men find in expressing themselves, or readily ascertaining the meaning of others, whether in speaking or in reading and writing, is a serious impediment to business, in times when clear understanding and prompt despatch are of growing importance as the relations of men become more complicated, and the pressure of affairs more urgent. On the many occasions when time is money, slowness in calculation may be, in the short run, a cause of as much loss and hindrance as miscalculation is sure to be in the long run. And further, an ignorance of places and events may lead to a total inability in any practical sense to follow up the opportunities, or avoid the special risks of a man's own times, nation, or trade.

Beyond his social position and his business, there are other relations in which to have attained a distinct standard of education will conduce even more to a man's happiness and usefulness. But lest I should be thought out of place, I will only say that I allude to religion and politics,—two subjects on which all men must think, and many will both think and speak strongly, but on which the ill-informed are almost sure (to say no more) to perplex themselves and mislead others.

Education, however, does not consist only of information. It is not so much what a man *knows* as what he *is* that will determine his conduct and success in life. And this a mere examination can never ascertain. I do not speak only of raw, undigested knowledge; for even sound knowledge carefully learnt and stored,—such as it is the peculiar attribute of a *good* examination to distinguish from mere cram,—even this is unimportant compared with the character and habits of the man, and espe-

cially the practical knowledge of himself and others which, though it may and often is an accompaniment of scholarship, is not so by necessity. It is therefore desirable that the degree which certifies the attainments should in some measure also testify to the training of the man. This can only be done when it is connected with residence.

A University degree at Oxford and Cambridge now implies not only that a man has so much knowledge of classics, &c., but that he has spent some three years at college, and that either he himself, or at least a large number of his fellow-graduates, had, previously to their college course, passed several years at a public school. And I think I may say with confidence, that the value of this training for life, which is thus implied, is even greater than the value of the knowledge certified by the standard of the degree. Why should not the same "training for life," through a school and college course, be opened to the sons of farmers and others? The period of such a course must necessarily be shorter than that which, on the average, prevails with the higher classes, and would end as much before as the other is protracted beyond the age of twenty. From seventeen to nineteen would probably be the period of taking the "county" or whatever be the general middle-class "degree." Farmers' sons at present often leave school as young as fifteen. With better schools and a definite object, their stay might and should be protracted to sixteen or seventeen, and still leave a year at least for a higher course of study, and a more manly training at college.\* What will be the number of those who will or can afford this prolonged sacrifice to education can only be ascertained by gradual experiment; but a very small proportion of the present boarders in middle-class schools would suffice to maintain a college in most of the large counties, or certainly in groups of contiguous counties. And if recent or future changes in the administration of the Government aid to education should lead to a change in the class of masters for the National schools, substituting for those who are educated at the Government expense men who have been able to provide their own education, the present Training College would, as has been long ago suggested by Lord Fortescue, frequently become an excellent nucleus for a County College.

And this leads me to pass slightly from the education of the

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\* I may be permitted here to deprecate the unmeaning and mischievous confusion of the terms "school" and "college" which is beginning to prevail. A larger or more pretentious school is at once called a college, and the distinction between the elementary instruction and discipline of the boy, and the more advanced and liberal education of the young man is lost. College should be the continuation of school, implying a protracted expenditure of time, money, and effort on the part both of parent and student.

farmer to that of his landlord on the one hand, and his labourer on the other. It seems very desirable that, as he will have so much to do with these in his business and after-life, so at some point or other of his education he should come into contact with both, and establish some links of fellowship and sympathy not inconsistent with his relative position towards either. These points of contact might be formed in the elementary day-school at the outset, and in the college at the completion of his course. If the elementary schools of England were under masters and mistresses who, in addition to sufficiency of knowledge and efficiency of teaching, enjoyed the advantage of respectable parentage, and the consciousness of honourable independence in their position, I see no reason why the children of all the middle classes, and the farmers especially, should not receive in these schools their first rudiments.

The labourer's children, as a general rule, could not go beyond these schools, or stay in them after the age of twelve. In agriculture, as in manufactures, children's labour seems to become more valuable with every improvement in machinery; and there is a constantly increasing need for the protection of childhood from the excessive use by parents and masters of this source of profit. Still, however this state of things may require to be regulated, it is in itself a happy circumstance that employment offers a very early maintenance to the labourer's children; for industrious earnings are of more value to society than unearned education. The early age, therefore, at which the labourer's child should reasonably be expected, and indeed encouraged, to leave school for work will always determine the limits of the elementary or village school. These should be further defined by accurate certificates of competence in the rudimentary subjects of writing, reading, and ciphering. It would be well if employers made such certificates available, if not essential, as introductions to service; at all events they would serve the employer's children as a mark of proficiency on entering the higher boarding or day school, the expense of which would be beyond the means of the labourer.

I must repeat, though I fear the opinion will grate upon the feelings of some parents, that if the elementary schools were generally under the charge of respected and efficient teachers, no injury would be done to the child of the higher class by sitting for a while on the same bench, and learning the same lesson, with the child of his father's subordinate; and it might be that many a kindly and pleasant association would spring up in after-life from the recollection of this early intercourse.

Again, if with the county colleges in which the farmers' sons would, after passing through school, end their education, there



should be connected special scientific instruction, with superior professors and apparatus, it might be expected that in these higher academies he might meet the son of the landlord, who, having passed through the public school, and perhaps completed his general education at the University, would seek in his own neighbourhood the advantages thus offered him as a preparation for his proper share in the practical business of life.

But beyond these points of contact the very best union between different grades would be promoted by the fresh opportunities which an intermediate public system, aided by endowments, would afford, both for the best sons of the labourers, through merit and industry, to enter the higher schools of their employers, and also for many of the farmers' sons by the same means to pass on beyond the county schools and colleges into the higher universities.

The views which I have thus rather intimated than urged respecting education in connection with agriculture are not recently formed, and have been applied to the test of some practical experiment. I have found that a proprietary public school has been welcomed as a boon by the farmers of the part of England in which I live. I have found that the expense of establishing such a school has not been disproportionate to the resources of the district which it benefits, and that a self-supporting system of public education which had been looked upon as a hopeless problem begins to be no longer so regarded. It has been found necessary, in order to maintain the efficiency of the teaching in the Devon County School to connect it closely with the Middle Class Examinations established by the Universities. Indeed, this has been the first school in England that has become of itself a local centre for the Cambridge Examinations, and already in two consecutive years it has required the whole of its first and second classes to pass through that useful, because strict, ordeal. But these University examinations were anticipated, if not suggested, by the proposal for a County degree. And though I have had few opportunities of conferring with the promoters of the University scheme, yet observation and reflection have made me think that these schemes will not permanently supply the wants of the middle classes, while they may impair the position which Oxford and Cambridge now hold as completing the education of the higher classes. Either the Cambridge plan of giving a certificate only, or that of Oxford which confers the titular degree of A.A., must, one would think, be adopted eventually by both. But the certificate without the title will be deficient in honour compared with other degrees, and the new title itself, if maintained, will stand in invidious relation to the older titles of resident graduates. This dis-



appointment or this rivalry would not attach to an independent degree conferred by a special "Royal County University," as proposed by Lord Fortescue in his pamphlet just published,\* with its own affiliated colleges and schools through the various counties of England. The constitution of that University might in form and effect be analogous to that of the Royal Agricultural Society itself. The most honoured names of the country might be connected to give it distinction, the wealthier landlords and farmers would endow it with scholarships and fellowships, while the cost of its annual examinations and degrees would be easily defrayed by the ordinary subscriptions or fees paid by the numerous and important class it is intended to serve. The colleges and the schools connected with it would, as in the case of the Devon County School, owe their foundation to local interests, and be maintained by the payments of students, with such assistance as the liberality of local benefactors might yield. And if, as I have ventured to anticipate, these schools and colleges were to supply from the sons of the independent classes well-trained and well-conditioned masters for the elementary schools as well as for their own, it would not be unreasonable to expect that some portion either of the Government annual grant or of the hitherto neglected or misused educational endowments of the country might be applied to provide subsidies, or, better still, retiring pensions for such masters.

Under such a system one might venture to anticipate a remarkable change in our agricultural districts. England would be England still, with no abrupt revolution in the habits or mutual relations of its several classes; but education, the improvement of man, would keep equal pace with other improvements. The rising wages of the labourer would enable him to afford that which the example and countenance of his employer would recommend—the education of his own children according to their station. The cost of suitable elementary schooling is now declared by authority to be 30s. per annum. Even this, if the parent paid it all, would in many districts be no disproportionate burden to the wages earned. But this 30s. includes a large estimate for the cost of educating teachers. This, according to the views I have advocated, might be entirely deducted if the teachers were by a different system drawn from a class who can afford to provide their own education. But the Government grants, though objected to by many, are so established and accepted that they are not likely to be withdrawn. The resources of charity also, whether by endowment or subscription,

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\* 'Public Schools for the Middle Classes,' by Earl Fortescue, Patron of the Devon County School. Longman and Co., 1864.

supply very large subsidies for the instruction of the labourer's child. There is, therefore, no reason why in every village or district in England a thoroughly good elementary school should not be maintained at a cost of from 6*d.* to 9*d.* per week, according to the number of children; and this cost may again be reduced by a half or more by (1) the State grants, (2) voluntary subscriptions, or (3) the industrial earnings of the children themselves. A school of 50 to 100 children thus maintained would offer to a master taken from the middle classes a higher proportionate salary than most curacies do to the sons of the gentry; and if those elementary schools, instead of being as now exclusively assigned to a dependent class, were so constituted that the children of the employers might use them without injury or loss of respect, then the masters of these schools, being themselves of independent parentage, would look to promotion and higher salaries in the more important public boarding-schools to which some of their elementary pupils would proceed, and where the bulk of the middle classes would be educated.

All who take an interest in the welfare of the English labourer must rejoice at the attention that is now turned to the improvement of their dwellings. But a still more important improvement of the home must accompany the improvement of the house. The true degradation of the labourer is his lack of self-respect. His sense of the value of those belonging to him should accompany the sense which improved wages and dwellings will give him of his own value to those in whose service he is placed. To turn the hearts of the fathers to the children, and, by consequence, the hearts of the children to the fathers, is the true method of "making ready a people for the Lord," which phrase implies all, and more, than is commonly meant amongst us by improvement. Writing in pages that may be read by some of the most powerful employers of agricultural labour in England, I shall be pardoned if I express myself warmly on this subject, and claim for it a more serious attention than it has yet received. The parish school should be the special charge of every good farmer quite as much as of the clergyman or the squire. It should be the subject of his thoughts and of conversation with his neighbours; for, whatever may be the value to him of other machinery or inventions, let him be sure that there is none that will more affect his prosperity as a farmer and his satisfaction as a man than this machine for the cultivation of his labourer. Let him determine to assist in making it work, constantly, easily, and efficiently. Let him consent—I do not say condescend—to take the requirements of his own younger children as a gauge of what his labourers' children also should receive. Let him ascertain, not illiberally yet with practical economy,

the necessary cost, and seek to apportion it fairly among the recipients. Let him not think that either charity or wisdom require us to *give gratis* food to the mind any more than to the body; but rather by every encouragement to make this food an object of general desire, within the reach of average industry. Need I say that by this very appeal I am supposing no low standard of education for the farmer himself? And yet, whatever may be the honourable exceptions to be found in certain individuals, or even certain counties or districts, I fear it is a truth too real to be disavowed that the low standard of the farmer's own education has been the principal impediment to his encouraging as he ought the education of those he employs.

*West Buckland, South Molton.*

## APPENDIX.

### DEVON COUNTY SCHOOL.

*Debtor and Creditor Account, from the Foundation in 1858 to the End of 1863.*

DR.	£	s.	d.	CR.	£	s.	d.
To 225 shares (25 $\frac{1}{2}$ .)	5,625	0	0	By old buildings ..	937	18	8
Mortgage and loan ..	966	5	0	New buildings and land	4,345	8	8
Old buildings sold ..	315	0	0	Repairs of building ..	36	0	0
Subscriptions for play-ground .. .. }	153	13	0	Furniture .. .. }	879	15	5
Boys' payments .. ..	5,001	7	11	Books and advertise-ments .. .. }	477	18	8
				Preliminary and incidental .. .. }	267	3	6
				Salaries .. ..	1,071	7	10
				Board .. ..	3,957	19	1
				Balance .. ..	87	14	1
	12,061	5	11		12,061	5	11

*Statement of Receipts and Expenditure on Revenue Account, for the Year ending December 31st, 1863.*

DR.	£	s.	d.	CR.	£	s.	d.
Salaries .. ..	188	19	6	Charged to boys for board and tuition .. }	1298	19	0
Board .. ..	995	11	6	Charged to boys for sundries .. .. }	335	4	6
Books, including prizes	21	19	8	Donations for prizes ..	12	7	0
Repairs of building ..	36	0	0	Scholarships given by Rev. J. L. Brereton }	9	15	0
Furniture .. ..	47	14	10	Balance .. ..	51	2	2
Advertisements .. ..	11	4	9				
Sundries .. ..	13	3	10				
Taxes and interest ..	46	5	1				
Sundries supplied to boys .. .. }	336	13	6				
Scholarships .. ..	9	15	0				
	1707	7	8		1707	7	8

*Four weeks' Housekeeping Account, from November 5 to December 3, 1861.*

					£	s.	d.
Baker ..	1,552	lbs. bread	..	..	11	15	4
Miller ..	140	lbs. flour	..	..	1	3	0
Butcher ..	1,055½	lbs. meat	..	..	26	1	11
Brewer ..	36	gallons beer	..	..	1	16	0
" ..	64	gallons cider	..	..	2	0	0
Coals ..	75	cwt.	..	..	4	13	9
Dairy ..	..	butter and eggs	..	..	4	5	2
" ..	133	quarts of milk	..	..	0	11	6
Grocer ..	14½	gallons of oil, &c. &c.	..	..	10	18	6
Green-grocer ..	..	potatoes and vegetables	..	..	3	19	4
Sundries ..	..	..	..	..	1	11	6
Washing ..	..	..	..	..	2	1	8
Wages ..	..	..	..	..	6	18	0
					<hr/>		
					£	s.	d.
					77	5	8
43 boys, four weeks at 8s.	..	68	16	0	}	74	16
3 masters ..	10s.	6	0	0			
6 servants	..	..	..	..			
					<hr/>		

52 total.

2*l.* 19*s.* 8*d.* excess on our average, but this included 2*l.* charged to head master for a private party.

1055½ lbs. of meat consumed by fifty-two persons in four weeks, being 36½ lbs. less than ¾ lbs. for each person per diem.

1692 lbs. of bread and flour, ditto, being about 1½ lb. for each person per diem.\*

*Remarks by the Editor.*

A few words of explanation gathered from the Appendix to Lord Fortescue's Book may be of service, and first it may be remarked that the scheme contemplates the creation of 300 shares of 25*l.*; therefore 75 such shares are still to be disposed of; if these should be taken up the mortgage and loan might be paid off, and a balance of 900*l.* remain in hand.

It appears that the aggregate of the boys' payments from the first to the end of 1863 nearly balances the outgoings for salaries and board; but for the year 1863, the boys' payments exceed "Salaries" and "Board" by nearly 114*l.* In 1863 there were 50 boarders; the present year starts with 60.

The records of this institution show how it has gradually moulded itself on the requirements of the times and the dictates of experience; and in this point of view it is interesting to compare its existing financial position with the scheme

\* Mr. Brewer, steward to Earl Fortescue, examined these accounts from Aug. 15 to Dec. 31st, 1861, and certified that, allowing 9*l.* 10*s.* for extra expense at the opening of the new buildings, the expense for board, service, and washing averaged 8*s.* per week for each boy, and 10*s.* per week for each master.



which Prebendary Brereton propounded in 1853 and expanded in 1858, as well as with the prospectus published in 1862.

In his letter of 1858, Mr. Brereton contemplated a large infusion of the "industrial" element, and whilst the proposed charge for a boarder, who did five hours' work on the farm, was 20*l.* per annum, he who did no work was expected to pay 45*l.*

It is very satisfactory to find that *actually* the question has been whether 23 or 25 guineas should be the total average charge, a small difference being made between the senior and junior classes.

The same letter proposed a graduated scale of charge for tuition for day scholars of from 5 to 10 guineas per annum.

*The prospectus of 1862* assumes the following shape:—

	£	s.	d.
For buildings .. .. .	4000	0	0
For furniture .. .. .	1000	0	0
For advertising and preliminary expenses .. ..	500	0	0
For working capital .. .. .	500	0	0
	6000	0	0

"The permanent school," it is there stated, "will, when completed, have cost 3000*l.*, and have ample convenience for at least 100 boarders;" some temporary wooden buildings with other incidental expenses had cost 1000*l.* The tentative process adopted in the formation of this school, though wise and prudent, was not conducive to ultimate economy. The excess of the actual expenditure over this estimate being mainly due to the expedient of "temporary buildings."

The board of the boys, including food, washing, and attendance, is estimated at 8*s.* per week, that of the masters at 10*s.*, for 40 weeks in the year. An additional sum of 1*l.* per head is added to cover casual expenses.

The Educational Staff consisted of a head master and three assistants.

The head master cost, including board and washing, 120*l.*, he had besides a comfortable house in the buildings. The undermaster's salaries and board amounted to 150*l.*; including extra masters, the cost of tuition made altogether 300*l.*

Annual repairs were estimated at 100*l.*; a liberal allowance. It was calculated on this basis that if the school were full, a dividend of 500*l.* on a capital of 6000*l.* would accrue.

Some of these items call for special consideration from those who would copy this model; a very little consideration and knowledge of the world is required to see that a great deal of labour of love is here performed, which is not and cannot be charged in the account. The sum of 300*l.* is but a poor pro-

vision for the instructors, if all the responsibility, the discretion, and the ruling power required, is to be provided from this fund. Apart from endowments, which are in contemplation, or gratuitous service, the payment of 5*l.* per boy, to provide a fund of 500*l.*, is probably the lowest that can ensure efficiency; and this is a lower rate per head than Mr. Brereton contemplated in 1858, when he included the cost of supervision on an extended scale in the account.

If we would make a separate estimate of the cost of *lodging*, we may reckon that to provide 5 per cent. interest on 6000*l.* (300*l.*), with 140*l.* for repairs and taxes, 440*l.* in all, a payment would be required of 4 guineas per head from each boarder, besides a 1 guinea fee from, say 20, day-boys.

The board, as we have seen, is set at 17*l.*; any estimate, therefore, for general application would probably allow—

	£	s.	d.
For board .. .. .	17	0	0
For lodging .. .. .	4	4	0
For tuition .. .. .	5	5	0
	<hr/>		
	26	9	0

Or, say, 28*l.* for the senior class, and 25*l.* for juniors.

This review would be very incomplete without some mention of the endowment of the chaplaincy with 1000*l.* by the late Earl Fortescue, as well as of the scholarships or prizes already presented or in contemplation.

Prebendary Brereton now gives annually two scholarships, one of 15*l.*, the other of 10*l.*, and it has been so provided that his benefactions will be made permanent. The present Earl Fortescue has offered 500*l.*, and the late Hon. J. Fortescue left 200*l.* for the endowment of scholarships connected with this institution. The Bishop of Exeter gives a scholarship of 5*l.* for knowledge of Holy Scripture.

W. H. Hooper, Esq., the Rev. H. S. Pinder, Lord Poltimore, and the Rev. W. Thorold have likewise given smaller benefactions.

A residence of thirty years in the University of Cambridge gives me some confidence in avowing my belief that in no other way could benefactions of this kind and extent have been made so telling in our present social and intellectual position.

At Cambridge a scholarship of 10*l.* or 15*l.* a year is almost valueless, so little does it contribute to the sum of a poor scholar's necessary expenditure, while as badges of proficiency we have enough and almost to spare of such rewards. In a county school, a *scholarship* in the usual sense, tenable for two or three years,

not merely an annual prize, would give continuity, as well as life to the course of study.

The bare mention of such scholarships is very suggestive to those who are familiar with the fate of such endowments at Cambridge and elsewhere. Here in many instances the unforeseen change in the value of money, in some, want of equity in the interpretation of Statutes, has converted that provision, which in primitive times was a fair maintenance for a scholar, into a trifling honorarium.

Hence Exhibitions to the Universities, which once served to leaven the grammar schools to which they were attached, now go a-begging, or are not filled up. These institutions once gave an adequate impulse to the education of the whole class of yeomen, when it occupied (relatively to the learned professions, to commerce, and to trade) a more important position than at present. We have, therefore, not so much to deal with a new want, as to meet the defects which decay, social changes, and abuses have wrought in a once sufficient provision.

It may be asked, Why not, as of old, connect such provision with the Universities? Various considerations, however, lead to the conclusion that it is easier, if not better, to create new machinery than to attempt to resuscitate the old.

Rightly or wrongly our ancient Universities seem hardly to desire to attract to themselves really poor scholars, unless they be of remarkable ability. Without a revolution in the social habits of the students, they could hardly there find a place; and such habits, if not beyond control, yield but slowly, and then to example or religious principle rather than to prudential motives; and, lastly, on such large and rich bodies any new influence must be exerted on a large scale if it is to be effectual.

If, then, we turn to such new institutions as that which "the genius of Mr. Brereton has planned, and his liberality, energy, and judgment has established,"\* we may yet gather for them some useful warnings from the history of our old foundations.

The importance of endowments *in real property* will be one such lesson. If all our old benefactions had assumed this form instead of being often money-charges on real property, and if the proceeds had been equitably administered, in all probability the constitution of our body of students at the old Universities would have rested on a far broader basis than at present.

On such benefactions, however, the Statute of Mortmain imposes a salutary check. A special charter might remove such difficulty, but then it would further swell the list of preliminary

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\* Taken, nearly verbatim, from the late Lord Fortescue's inscription on Mr. Brereton's bust, presented by him to the Devon County School.

expenses, and it is a significant feature of the times that the estimate of 500*l.* "for preliminary expenses and advertisements" (on a total outlay of 6000*l.*) was even in the case of the Devon County School considerably exceeded.

In conclusion, let me express a conviction that, as practical men, our leading farmers will recognise the importance of a public school education for their sons; not so much for its promise of book-learning (*comparatively* a weak point) as for the presence of mind and steadfastness in difficulties, the power of coping with men, the promptitude of thought, word, and action, which such a course of training imparts and fosters.

P. H. FRERE.

Cambridge.

#### IV.—*Essay upon the Manufacture and Preservation of Cider and Perry.* By CLEMENT CADLE.

##### WORCESTER PRIZE ESSAY.

THE differences that are met with in cider and perry, even when made at the same time, by the same maker, and under the same system of management, must strike the merest tyro in the art as something strange, showing how very little is known of the scientific principles which regulate the conversion of the juice of apples either into a sweet, pleasant beverage, or into a hard, sour drink, palatable only to persons long accustomed to its use.

Having paid considerable attention to this subject, I shall endeavour, in the following Essay, so to combine "science with practice" as to render it acceptable to the most matter-of-fact farmer or maker, whilst, by drawing attention to the scientific aspect of the subject, I hope to induce others to put their shoulders to the wheel, with the conviction that such light may be thrown in various ways on the manufacture of cider and perry, as may render them, in their improved character, nearly equal to the wines of warmer climates.

The subject, according to the directions given in the announcement of the Prize, may be subdivided as follows:—

1. Time and mode of gathering the fruit.
2. Different modes of grinding and pressing.
3. The fermentation and after-management.
4. General remarks on the subject.

##### 1.—*Time and Mode of Gathering the Fruit.*

Practice in these respects varies considerably at present, the most usual way being to let about one-half or two-thirds of the



fruit fall, and to shake and knock the rest off the trees ; but by this plan the trees are much injured for the next crop.

The windfall should be kept apart from the riper fruit ; and that this may be the better done, the ground should be carefully picked over once every second week, and the fruit kept separate in the apple-yard.

Any experienced person will be able to decide when the crop is ripe enough for being gathered ; the mellowness of the fruit, and the ease with which it can be shaken from the trees, readily show this ; and it is impossible to lay down any rule as to time, owing to the differences of climate, soil, and season.

When the fruit is ripe, and the day fine and dry, a careful man should be selected to go over the trees, armed with a light pole having a hook at the smaller end, with which he gently shakes each limb or branch in succession.

The fruit should then be carefully picked up, free from leaves or twigs, the small apples being put into separate baskets, to be taken to the apple-yard, for second-class cider ; the best fruit may then be carted to the apple-loft. They should at first be spread in the loft about 12 to 18 inches thick, but after a week or nine days, may be thrown up to a depth of 24 to 30 inches. When the apples are moved for this purpose any rotten ones had better be removed to the mill, and any small or unripe fruit, which escaped notice at picking, should be taken to the apple-yard.

This process of shaking and storing should be repeated in about a fortnight ; but where the orchards are large, when they are all once gone over, the men can commence again a second round. During the second process of shaking it is important that none of the fruit should be knocked off, as such, not being fully ripe, will not do for the apple-loft.

When the trees are gone over again for the third time, the remainder of the crop may be shaken off, no more violence being used than is absolutely necessary. This third gathering must not be taken to the loft, but should be put in the apple-yard with the sortings of the first and second gatherings, unless you happen to have plenty of room under cover. As this portion of the fruit did not ripen so early nor so fully as the rest, it is best mixed with the windfalls and sortings for making second-class cider. The general practice is to leave all the apples in the apple-yard exposed to the weather until ready for grinding, few persons having proper accommodation for housing them. When such a course is pursued, it is important to separate all rotten ones before making, for even if, as some persons consider, the black rot in fruit is alone injurious to the cider, still, it is always best to err on the safe side.

The fruit should not lie more than 2 feet thick in the heap, or

it is liable to become heated; and a depth of 1 foot would be preferable. In frosty weather it is essential to have the heap covered with a good coating of sweet wheaten straw, which should be removed when the frost is gone; but hay must not be used, as it gives a taste to the cider.

Fruit is much injured by frost on account of its breaking up the structure of the apple. The juice becomes solid when frozen, and increases in size; the cells are then burst, and any rain which afterwards falls upon the heap washes out the saccharine matter from the damaged portions, and this encourages decay in the other fruit.

To the management of pears the same remarks apply with equal, if not greater, force, more especially as regards the removal of windfall and rotten fruits.

If the perry is required for bottling or long keeping, careful selection of the fruit is imperatively necessary; but if for early drinking, the same care need not be taken.

When it is desirable to preserve a portion of the fruit for eating or culinary purposes, it should not be allowed to get too ripe on the trees; and generally, the longer it is intended that an apple shall be kept, the greener should be its state when picked.

The best mode is to take a ladder, and with a small basket hand-pick the trees over a fortnight or three weeks before the general crop would be ripe enough to collect for cider, choosing a dry day, and not commencing till after the dew is off.

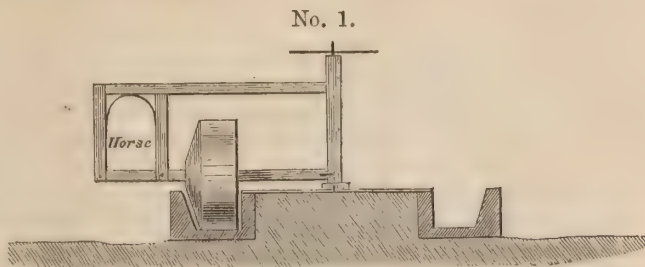
The store-room should be dry and, if possible, on the ground-floor, as the frost affects the fruit more in lofts, especially if not ceiled inside. The fruit should be placed between good thick layers of sweet wheaten straw, and left until required for use.

## 2.—*The Different Modes of Grinding and Pressing.*

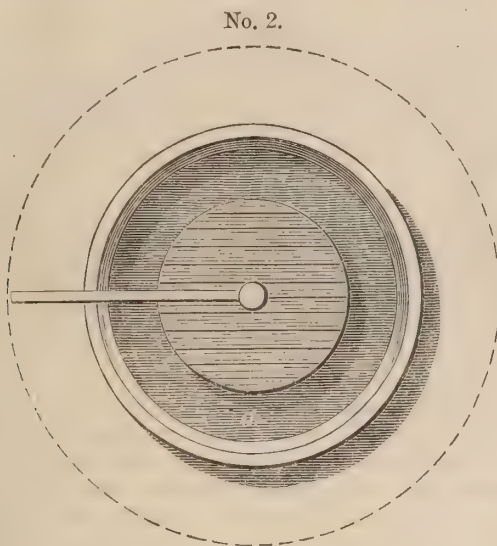
Within the last few years a great alteration has taken place in the way of grinding in the counties of Hereford, Worcester, and Gloucester, by the adoption of a system which has long been the custom in Devonshire. Our old plan was to place 8 or 10 bushels of fruit in a circular trough (*a* No. 2), round which a stone runner of about a ton weight was propelled by a horse (see Plan No. 1) until all or nearly all the kernels and the apples were ground to a fine pulp. To accomplish this the sooner, the boy attending to the horse had to move the partially-ground pulp from the sides of the circular trough to the bottom. This grinding was usually continued for about two hours more or less, according to the mill and the fruit. The pulp was then put up into horse-hair sheets and pressed, and the liquor running from it received into a stone cistern or vat.

The cumbrous old-fashioned press, with its wooden screw and

capstan, has long been superseded, although the capstan is still in use in Devonshire.



Section of Cider Mill.

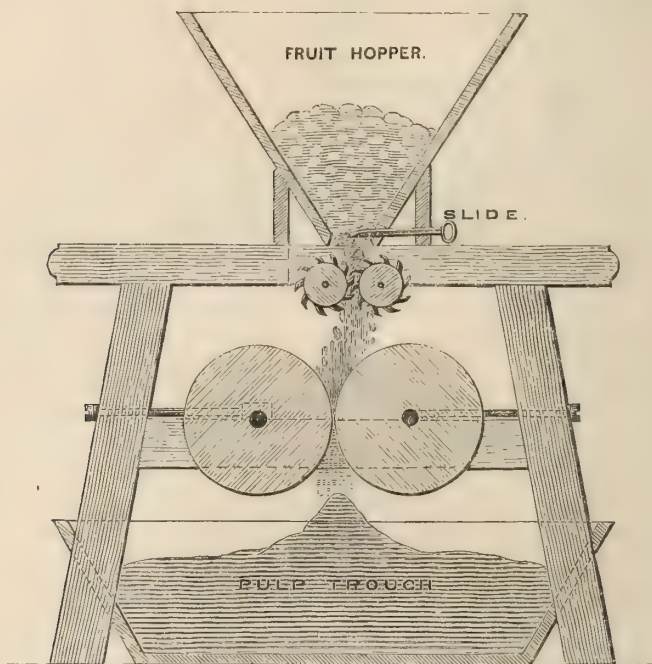


Plan of Cider Mill.

*Scale 8 feet to an inch.*

About 26 years ago Mr. Coleman, of Chaxhill, Westbury-on-Severn, commenced making an improved cider-mill and press, which could act either as a fixture or a portable mill. (See No. 3.) It was found that the cider thus made fined better, and the process was also more expeditious. These advantages, together with the cost of keeping the old kind of mills in repair, which landlords were unwilling to undertake, led to their being superseded, as they wore out, by Coleman's or a similar mill.

No. 3.

*Mr. Coleman's Cider Mill.*

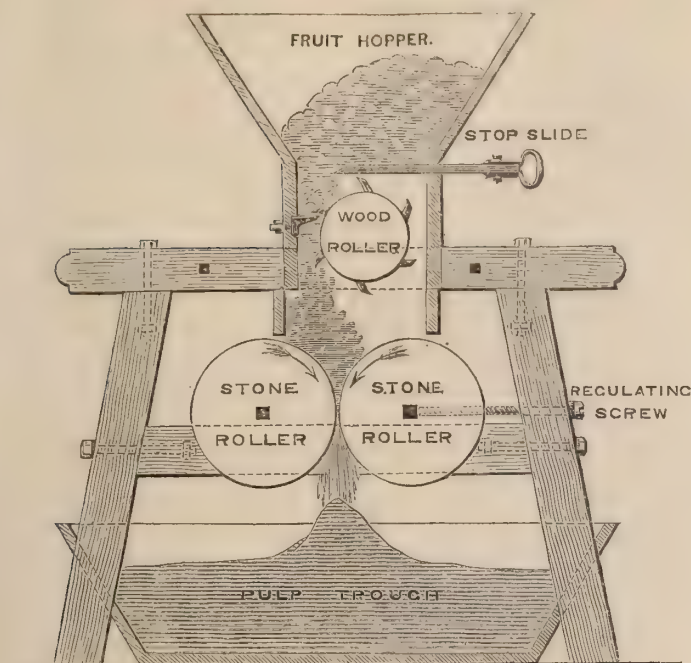
Coleman's mill consists of two pairs of rollers fixed in a strong wooden frame; it is fed from a hopper, the apples passing through the first pair of rollers, which are made of hard wood, with iron teeth, so as to break the apples, which fall next between a pair of stone rollers set close enough to break the kernels, and from these the pulp drops into a trough placed beneath to receive it.

Mr. Latchem, of Hereford, has also paid considerable attention to the construction of these mills, and has taken out a patent for doing away with the iron in the feed-rollers, and substituting steel teeth fitted into one roller, and working through other steel teeth on a fixed plate, partly on the same principle as a curd-mill. The fruit, after passing this "chewer," is ground between a pair of stone rollers, as before described.

The pulp is removed from this trough to the press, which consists of a very strong wooden frame made of four pieces of oak morticed together, having a platform made of strong planks wide enough for the "cheese" to be built upon it. Between the uprights of this frame a moveable cross-piece is placed, which is grooved



*Cider Machine—P. Latham's Patent.*



Scale 1 foot to an inch.

at each end so as to work up and down a tongue on each upright of the frame. To the upper side of this cross-piece two screws are fixed which work into the top of the frame. The pressing the pulp is usually carried out in this manner:—A small box-frame is prepared by nailing together 4 pieces of board 8 inches deep, and of such length as the platform will conveniently allow. On such a box a piece of hair-cloth is laid, and this is filled with pulp; the corners of the cloth are then turned in, the box gently raised, and another cloth laid upon it, which, in its turn, is filled with pulp; and this is continued until the cheese is built up to the required height. We then place upon the cheese a square piece of plank which overlaps 6 or 8 inches on each side, and the screws being turned alternately, the pressure causes the liquor gradually to run on to the platform, which has grooves cut in it to convey the cider into a vat or tub, from which it is removed to the cask.

In Devonshire the system differs from this; their plan being to have an apple-loft over the mill, or pound-house as it is there called. A raised driving-way is provided at the back, so that a

cart can be driven up and tilted. The apples are thus easily got into the loft. Under this loft is the mill, which is fixed high, and fed through a hole opened in the loft; there is little other difference except that in their mill the pair of upper rollers are of fluted cast iron. From this mill the pulp is placed in the press, as before described. Formerly, the cheese was built in straw, but this has now given way to "cider-hairs;" and I am informed that the use of straw is now very rare.

The capstan seems to be still used there, and also the single iron screw, but this has a catch at the bottom to prevent the screw running back on great pressure being applied.

Until the portable apple-mills became general, we had a mill to almost every farm, and even to many of the cottages; but in Devonshire one mill or pound-house serves for a number of makers, and sometimes for a parish, each person paying so much per hogshead for the making.

Most of the travelling portable machines in Herefordshire have two presses with each mill, and are worked by two horses, making 1000 to 1500 gallons in a day; sometimes they are worked by a small portable steam-engine. They are very expeditious, and do very well for second-class cider, but if you would have the best, they are very objectionable, because the different sorts of fruit very rarely get ripe at once in sufficient quantities to enable you to make much at a time. Much cider is therefore spoiled, the fruit being ground when too green, by those who are impatient to finish the process. I think that each farm or holding should have a mill of its own, even if it be only a small hand-mill.

There are several other rude plans of grinding, such as nut-mills, graters, scratchers, &c., but they are so objectionable that they hardly deserve notice.

All metallic substances should be kept from contact with the pulp, as chemical combinations immediately take place on contact; for instance, if you take a clean knife and cut an apple through, the knife quickly becomes black, as well as the apple. For this reason I think the iron teeth and cast-iron in the rollers are objectionable, as also the steel ones, although perhaps not to the same extent. I should recommend that this iron be removed, and fluted rollers of larger diameter be made of some hard wood, such as yew-tree, or American iron-wood. No doubt more power would then be required to work the mills, but this would be of little consequence if the produce was first-class cider.

When this new mode of grinding was first tried, there was great complaint amongst the labourers that the cider did not agree with them, and this was generally attributed to the iron; but in my opinion, the green state of the fruit when ground made the juice harsh, and caused irritation in the system.

The use of mangolds before they get ripened either by the action of the frost or by storing, appears to exert a similar unfavourable influence on stock.

One of the great errors in our present system of cider-making is that the pulp is pressed too soon after the fruit is crushed. Under the old system the grinding took several hours, and this delay was beneficial. Even now, most judges of cider will tell whether the cider is made on the old system or on the new: the latter creates such a peculiar harsh taste that many of the very best makers even now prefer the old mill.

Much of the flavour and richness of cider depends upon the fermentation commencing before the pulp is pressed, for by this means the essential oils in the kernels are extracted, and the juice becomes more perfectly prepared for producing a full-bodied cider. It has long been the custom in Devonshire not to press out the juice till the day after the apples are ground into pulp; and several makers have assured me that the best cider was that which was ground on Saturday and not pressed out till Monday. In our own district many makers under the old system, when they want to make some very prime cider, prefer letting the pulp remain all night before it is pressed. The adoption of this alteration may be strongly recommended; it only requires an extra vat or two to hold the pulp, whilst the improved result will, I am fully convinced, amply repay the little extra trouble involved.

In pressing the cider it is very important to take plenty of time, and do it gradually, for if the liquor rushes through the hair it takes with it much more sediment than is desirable: the clearer it is the better.

We may well take a lesson from the manner in which wines are fermented, as much as three or four days being allowed to elapse between the crushing of the grapes and the removal of the clear liquor, which is then allowed to run off as bright as possible.

When pressed for time many makers of wines crush and press their wines at once, making a white wine; but this is of inferior quality, since the colour, flavour, and aroma of the fruit can only be extracted by the slower process.

### *3.—The Fermentation and After Management.*

In making cider it is very essential to have the fruit as ripe as possible, not only for the sake of the saccharine matter, but also of the essential oils derived from the ripe kernels, which influence the keeping qualities as well as the flavour of the cider.

Dr. Voelcker has kindly furnished me with the following analysis of some common Somersetshire cider, such as is used by agricultural labourers:—

*Quantity per Imperial Pint.*

	Grains.
Water .. .. .	8292·41
Alcohol .. .. .	367·69
Grape-sugar .. .. .	31·67
Gum and extractive matters .. .. .	45·05
Albuminous compounds .. .. .	1·94
Malic acid .. .. .	44·86
Mineral matter (ash) .. .. .	18·38
	<hr/>
	8802·00

The above analysis shows that a large quantity of malic acid is present in the cider, as well as in the apple in its natural state, and it is this acid which gives the rough taste so much relished by cider drinkers, although in many writings upon this subject it is mistaken for either lactic or acetic acid.

The first point to be secured is by the proper exposure of the fruit to the sun to get the starch and pectin, which is largely contained in unripe fruits, converted into grape-sugar as much as possible, and this change is further assisted by keeping the fruit some time after it is picked. After breaking or grinding the fruit, the first change results from the combination of the oxygen of the air with some of the materials of the fruit, upon which, no doubt, the colour depends, for, according to Liebig, "we are able, to produce from malic acid and ammonia aspartic acid,\* which is colourless and crystallized, produces, when oxygen is present, by absorbing ammonia, the splendid red dye orcein."

When a ripe apple is cut or broken through and exposed to the air, it becomes of a beautiful red colour in a short time, probably from the same action. Should this theory be right, it affords another inducement to gather the fruit as ripe as possible, for we know that cider made of unripe fruit is of a pale colour.

From the albuminous substances in the fruit a vegetable ferment is formed, which, after the vinous fermentation is over, it is very essential to get rid of as completely as possible. This ferment acts by changing the grape-sugar into alcohol and carbonic acid, thus: 1 equivalent of alcohol consists of 4 equivalents of carbon, 6 of hydrogen, and 2 of oxygen; 1 ditto of carbonic acid of 1 equivalent of carbon, and 2 of oxygen; 1 ditto of grape-sugar of 12 equivalents of carbon, 12 of hydrogen, and 12 of oxygen; and the change would be that each equivalent of grape-sugar produces 2 equivalents of alcohol and 4 of carbonic acid, thus:—

	Carbon.	Hydrogen.	Oxygen.
2 equivalents of alcohol ( $C_4, H_6, O_2 \times 2$ ) ..	= 8	12	4
4 equivalents of carbonic acid ( $C, O_2 \times 4$ ) ..	= 4	0	8
	<hr/>	<hr/>	<hr/>
1 eq. of grape-sugar .. .. .	= 12	12	12



But of the cause of this change I believe very little is known. Professor Fownes, in his *Manual of Chemistry*, p. 417, says, "It is certain that decomposing azotised bodies not only do possess very energetic and extraordinary powers of exciting fermentation, but that the kind of fermentation set up is in a great degree dependent on the phase or stage of decomposition of the ferment." He thus evidently thinks there are different kinds of fermentation resulting from the condition or character of the ferment.

In a conversation I have recently had with Dr. Voelcker upon this subject, he told me that the principal point is to get a right kind of fermentation, as each kind of ferment produces a like fermentation in the liquor to which it is applied. Thus, if you apply the vinegar-plant (commonly called "mothers") you get a vinegar or acetous fermentation; from a top yeast you get a top fermentation; from a bottom yeast, a bottom fermentation; from a ropy yeast, a ropy fermentation in the liquor to which it is applied. It has been said that each kind of ferment produces a separate and distinct plant of its own; and this might possibly account for the different kinds of fermentation in cider, which I will now proceed to explain, only premising that the *temperature* of the *air* and the *condition* of the *atmosphere* exert a powerful *controlling* influence on the character of the fermentation which is produced.

We will first notice the vinous fermentation. This has different stages. The first change we notice is that in which the liquid throws some of the sediment out at the bung-hole, whilst another portion settles to the bottom, and this is often so completely done that the liquor remains clear and bright. When violent fermentation afterwards sets in it makes the cider or perry thick and turbid, even if bright before; and if this is allowed to go on it will spoil the cider in a few days. It is this second stage, or violent fermentation, which all cider-makers dread, and try to prevent, whilst the first they encourage as much as possible. This rapid or violent action is frequently mistaken for the acetous fermentation, because of the increased acidity of the liquor, which, however, may generally be traced to an excess of malic rather than acetic acid.

All cider-drinkers like the flavour of the malic acid; but no one likes the acetic acid, or sharp taste. Malic acid is the natural acid of the fruit, and as long as the sugar or saccharine matter is in excess only the sugar is tasted; but as the fermentation proceeds the sugar is gradually changed into spirit, and then the malic acid gets in excess, and you taste its flavour. This accounts for the fact which has puzzled many persons, that a cask of cider may be found sweet one day, but acid when tasted

the next day. The cider of which the analysis is already given contained 44·86 grains of malic acid to 31·67 of grape-sugar, consequently that sample no doubt tasted of the malic acid, which was in excess of the sugar; but in the apple itself there is 6·45 per cent. of sugar to ·11 of malic acid; hence all newly-made cider is sweet, and the greater the quantity of saccharine matter it contains the longer it will remain so, provided that the rapid fermentation is not allowed to go on. Malic acid, we have seen, is present in the apple before the juice is pressed; but the acetic acid does not exist until it is formed in the cider. You very seldom get it before May; and it is due either to the cask not being air-tight or to the cellar or place where the cider is kept being above 60° Fahr., unless, indeed, the cider should happen to be put in a cask which has some of the vinegar (or "mother") plant left in it, which will, of course, soon induce the acetous fermentation.

The third kind of fermentation is the slow fermentation: this is continually going on, even if the cider or perry is bottled, or otherwise kept free from contact with the air. This we cannot avoid, neither would it be advisable; for as the freshness of spring-water is due to the presence of carbonic acid, so likewise the sparkling properties of cider or perry arise from this gas—a product of fermentation without which they would be flat and unpalatable.

Some writers have supposed that malic acid is formed in the liquor as it matures by a gradual process of oxidation, such as the following series may represent: Alcohol ( $C_4, H_6, O_2$ ); then aldehyde ( $C_4, H_4, O_2$ ); then acetic acid ( $C_4, H_4, O_4$ ); and lastly, malic acid ( $C_4, H_3, O_5$ ).

But if this theory were correct, acetic acid must always exist before the malic acid is formed; whereas, *in fact*, the reverse is known to be the case. We must conclude that the malic acid exists naturally in the fruit.

### *The Management of Cider.*

The juice, when pressed out, if it be intended at once to place it in the cask, should first be strained: an old cider-hair which has got thick from use may be fitted to the tunpail, and if a little coarse charcoal is placed in the bottom it will be all the better; the cider or perry should then be strained so as to separate all the loose floating vegetable matter. It should remain in this cask, and on no account be racked or touched until it is perfectly clear from working at the bung-hole and from settlement to the bottom. Sometimes this fermentation will not commence without assistance, by the addition of a little of the active ferment from a cask that is working.

The vinous fermentation generally occupies a week or nine days, and sometimes even longer ; but as soon as the must drops from the bung-hole to the bottom, which will be in a day or so after it has finished throwing up, the liquor should be immediately racked into a fresh cask.

I should strongly recommend that the juice be strained into vats holding from one to three hundred gallons, and left there to ferment ; for the ferment generally separates better there than in the cask ; and the cider can be drawn off without disturbing the sediment at the bottom, or the scum and must floating on the top.

When this system is pursued it is very essential to remove the scum from the top ; and great care should be taken that this is perfectly done, for on this depends much of the after-trouble. This scum contains an active ferment which is very liable to get mixed with the liquor on tuning it into the cask, and this is certain to cause trouble : the same may be said of the "settlings." In all cases, before using a cask, it should be well washed, and, if not sweet, should have the head taken out, be well scrubbed, and put to dry. When a cask is wanted, it is desirable, before using it, to take a brimstone<sup>d</sup> match, or piece of brown paper on which some melted brimstone has been run ; this, after being lighted, should be suspended by a piece of wire inside the cask, and the bung inserted. As soon as the oxygen of the air is exhausted it will go out ; the remains of the match may then be removed, and the cask filled. This will take away any smell or unsweetness which the washing failed to remove, unless the wood be thoroughly saturated with bad gases, in which case nothing will thoroughly cleanse it, and the best way will be to direct the cooper to shave or pare the whole of the inside of the cask, and then let some freshly-ground must stand in it for a week or so, changing it every day. Too much care cannot be taken to have a clean cask, some hundreds of vessels of prime cider being annually spoilt from neglect in this respect. The liquor having now got over the vinous fermentation, and become clear, should be kept from the air as much as possible. The best means of accomplishing this is to place a bung in the cask, and, having bored a hole in it, fix a small tin tube with the longer end through the bung, and the shorter end inserted into a small tin can filled with water ; the tube will allow the carbonic acid to escape, and will save your cask. Many persons recommend bunging the cider up at once ; but in so doing you endanger your casks and the liquor. The accumulation of carbonic-acid gas consequent upon rapid fermentation would burst the cask, unless it should happen to be very strong ; but the use of the tube, whilst it allows the gas to escape, pre-



vents the access of air, and also indicates the state of the liquor. It is so cheap as to be at the command of everybody, and only requires a little attention to keep the water in the cans an inch or so above the bottom of the tube. If the supply of water is neglected, or if the tube is not properly fixed, the plan necessarily fails. The better to secure an air-tight joint, some clay should be moulded round the bottom of the tube next the cask.

The cider should be looked to every morning, when it will be easy to detect any case of rapid fermentation, by observing the rate at which the bubbles of carbonic-acid gas escape. In such case the cider should be immediately racked into a fresh cask, the tube and bung being placed in as before. When the old system is adopted, and the casks left open, they should be gone over every morning, with a lighted candle in the left hand, and in the right a stick about a foot long. This stick should be split at one end, and about an inch of candle inserted in the cleft. This being lit from the candle held in the left hand, is lowered to the bunghole of the cask. If the candle goes out, it shows that carbonic acid is given off and fermentation is proceeding too rapidly; the cider must then be at once racked into a fresh cask. By this means, with ordinary care, any rapid fermentation may be immediately detected, and kept under control. Should the liquor continue bright and clear till February, I should recommend that nothing further be done to it; but should it not be bright, it should then be fined with isinglass, &c., in the following manner:

Take an ounce of isinglass for each hogshead of cider, and place it to soak twenty-four hours in some cider or water, then beat it up with a whisk until it becomes a thick gelatinous frothy fluid; then rack about half a cask of cider, mix the isinglass liquid with a can full of cider, whisk them together, and pour into the cask, half filled with cider; then finish filling the cask to within a couple of inches of the top or bunghole. In about a week or nine days the cider should be racked off from the isinglass; and, should it not then be clear, the same process is to be repeated.

In Devonshire they use stewed or baked apples instead of isinglass. A sufficient quantity of large apples are put aside in the autumn, and, if the cider is not clear about the middle of January or beginning of February some of the apples are baked or stewed, then mashed and passed through a sieve to remove the cores, rinds, and kernels. They then take about a quart of this pulp, and apply it in the same way as the isinglass, already described. Many consider that it does not impoverish the cider so much as isinglass, but rather gives it something to feed upon. This is the cheaper process; I think it is immaterial which is used, so



long as they are properly managed; each acts by slowly settling to the bottom, taking with it the matter floating in the cider. Cider should always be racked off from the isinglass or apples; otherwise, in case of a change of temperature, or other causes, the sediment has a tendency to rise in the liquor, and the fermentation recommences. Should this fining process not succeed the first or second time, it may be tried a third time: as soon as the cider is fine and racked off, it may be bunged up.

It is important to get this fining done in cool weather, and before February is out; because "alcohol does not combine with oxygen at a temperature of from 46° to 50° Fahr., and the affinity is but slight at slightly higher temperatures" (*Liebig*). We seldom get the acetous (or vinegar) fermentation before March, and hence the importance of getting the fining completed, and the cider free from fermenting matter, before this time, when a temperature of 55° to 60° will occasionally be reached. After the cider is bunged up a coating of well-tempered clay should be put on the bung, to close it more completely.

Many casks of cider are spoilt from neglect of this precaution, and also from using bungs made of porous wood, and in some cases from the bung not properly fitting the bung-hole.

In the case of perry, some little differences may be made. The pears should not be allowed to get quite so ripe as apples (for they decay inside); and after the juice is pressed, it should be carefully watched after it is placed in the cask, as in from four to six days, or a day or two after the vinous fermentation commences, it will run freely through bags of very fine canvas, or brown holland. To render this straining more effectual the perry should be placed in open tubs, having some albuminous substance, such as blood, eggs, milk, or flour, mixed with it, and be there left from twelve to twenty-four hours. During this time the sediment and fermenting matter, if at the proper stage, will unite with the albuminous substance. In consequence of the difficulty of getting the liquid to run fine through the bags, conical bags slightly curved like a horn, are used, having a small hoop sewed on to the top of the bag: four, six, or eight of these are fitted to a frame. The perry should pass through these bags quite clear and bright in ten minutes after they are filled: to test the proceeding, let some be caught in a wineglass; if the canvas does not clear it sufficiently, some flour may be sprinkled on the inside of the bags. As soon as the bags are running perfectly clear and bright, the perry may be collected in a fresh tub; but all the previous running should be put by to be again passed through the bags.

This dropping of perry is a very simple operation, but it requires very great attention; care must also be taken not to touch or shake the stand while the process is going on. The clear

liquor is tunned into a cask, and the bags, after they stop running, are washed out and refilled in the same way; this being continued until the cask is completed. It may then be managed in the same way as cider with the tubes; clarified with isinglass in February; and finally bunged up securely. Should the tubes not be used, it is not advisable to leave perry too much exposed to the air after being dropped. A piece of slate or other flat substance should be placed on the bung-hole, otherwise the perry may become so flat that it spoils.

Various systems are pursued by the merchants or persons who make a business of fining cider, and sending it off to distant markets. They generally fix upon a store or cellar, and buy of the farmers at a certain fixed price on delivery at the store; some of them taking 50,000 to 60,000 gallons. As soon as the vinous fermentation is over, they watch it carefully, using the candle, as before described. Should rapid fermentation set in, a few canfuls of cider are put into a cask, and then a brimstone-match is burnt in it; the cask is then well shaken for five or ten minutes, so as to mix the gas thoroughly with the cider in the cask. This cask is then filled with the fermenting cider, and the process is again and again repeated on every appearance of rapid fermentation, until the ferment is destroyed. If the cider is not fine and clear, it is then made so, bunged up, and sent to the London and other markets. Most of the cider that is "matched" in this way has a peculiar taste, due to the gas (sulphurous acid) mixed with the cider, which is immediately detected by all cider-drinkers; it is consequently sent out of the neighbourhood. As merchants do not "match" all their cider, some of good quality can generally be obtained, if specially ordered. I cannot recommend this method, except when every other plan has failed. The beneficial action of sulphur may be clearly traced to the production of sulphurous acid, which renders the ferment harmless.\* The sulphate of potash has the same effect.

The colouring of cider, which is requisite in some cases, especially with the produce of some soils, is generally effected with burnt sugar. The sugar is placed over a very slow fire until the water is evaporated, being constantly stirred to prevent its becoming solid. A little may then be added to the cider until the required colour is obtained, which should be a rich amber tint. Another method is to soak some chips of logwood in some water or cider, and add it to the cask. The simplest and best plan is to grow a few roots of purple beet with the mangolds; these

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\* Liebig explains that this sulphurous acid, having a greater affinity for oxygen than the substances which excite acidification or than the wine itself, withdraws it from them, and in so doing, becomes converted into sulphuric acid.—*Letter xix.* p. 241, fourth edition.

may be ground like the apples and the juice pressed out. When the cider is racked, add from two to five quarts of the clear juice to each cask of cider, or a few may be placed in the mill, and pressed with the apples. I have seen a beautiful colour thus given to cider grown on dry sandy land, which would naturally have looked more like whey. Cochineal is also sometimes used.

*General Remarks on the Subject.*

I should recommend that the mill or cellar be built partially underground, for three reasons: 1st, To keep the temperature more on an equality in winter and summer; this should never exceed 55° Fahr., as whenever it rises to 60° Fahr. it favours the acetous change. 2nd, To facilitate the construction of a loft above for storing the apples, and of a raised driving way, which should, if possible, be on the south side of the building; all doors and windows to the cellar being on the north side. By this means the sun would be kept out, and the earth, by which the driving way is made, would keep the south side cool during the summer months. The third reason for this plan is, that the farther the cider is from the roof the better; and this roof must on no account be covered with slate, but with some light-coloured tiles or thatch, which will not draw the heat. The loft above can be used as a granary at other seasons of the year.

In recovering sharp or rough cider, it is a good plan to boil a few pounds of hops in some water, and pour them into the cask. If some molasses, treacle, or honey is added to the hops the improvement will be still greater; chalk may also be used for the same purpose. If lime is used, it must be exposed for a long time to the air; otherwise, by taking up the carbonic acid, it will make the cider very flat. Rossiter's and other compounds are largely used for this purpose; their active properties are, however, all derived from lime or chalk. These only partially *recover* the cider: our object must be to make it good and keep it so.

Most of the cider-merchants employ a saccharometer to detect any tampering with the juice before it is brought to them. This instrument gives the amount of saccharine matter. The density of the juice generally runs from 1070 to 1080—water being 1000. Various modes have been adopted to raise the proportion of saccharine matter, but without any real practical benefit. To test the use of sugar (which I suggested in my Essay upon the Making and Management of Cider, written for the Herefordshire Agricultural Society, in 1859) I made three hogsheads of cider the same day, and treated all alike; into one I put 20 lbs. of lump sugar, into the next 8 lbs., the other being left without any. The after-management was identical; and when I tried the cider, in six months' time, the cask with the 20 lbs. of sugar was no sweeter



than that which received none ; but it was exceedingly strong. I am therefore disposed to recommend the adoption of a good system of manufacture, rather than the use of sugar or spirit, to add an unnatural strength to cider.

In this essay I have very freely stated my views, in the hope, already expressed, that the attention of others may be drawn to the subject, which is well worthy of the attention of the farmers of Worcestershire, Herefordshire, and Gloucestershire. I am satisfied that the quality, and consequently the market value, of cider may be very much improved ; but at the same time I must add that the personal superintendence of the master is imperatively necessary ; for the first and last rule, as regards cider-making, is for the master to attend to it himself and not leave it to his men.

In conclusion, I will give the system pursued by Mr. Hill, of Egleton, near Ledbury, who took the prize at Hereford, in 1859, for the best hogshead of cider, and is noted for producing first-class cider. He says, "the best sorts of fruit are the Royal Wilding, Foxwhelp, White Beech Normandy, Yellow Styre, Handsome Mandy, and Skyrme's Kernel."

He uses mixed sorts of apples ; and when these are mellow they are well ground in an old-fashioned mill. The liquor is then strained, put into a cask, and racked as soon as fermentation takes place, and this is done again on every appearance of fermentation. After some weeks, if it is not bright, an ounce of isinglass is added, and this is repeated once a fortnight until the cider is quite as bright as sherry wine.

On each occasion of racking, the sediment or grounds are placed in tubs, mixed with some albuminous substance, and dropped through some bags ; a canful, or sometimes two, of these droppings is put to each cask after it is racked. Some hogsheads require three doses of isinglass, &c. ; others not half as much. This, of course, depends upon its fermentation. Cider, to be rich and full in the mouth, fit for bottling, should be allowed to ferment as little as possible.

By these means he has made cider and sold it as high as 5s. per gallon. He also told me that, as many of the old sorts of apples are going out, it is considered that they may be renewed by continual regrafting upon young stocks. Thus, take as good a graft as you can get, and put it on a good thriving stock ; and then in a year or so take another graft from this and put it on another stock, and so on. He has tried some three or four successive graftings in this way, and each time the tree shows more energy than the preceding one.



V.—*Report of Experiments on the Growth of Wheat for 20 Years in succession on the same Land.* By J. B. LAWES, F.R.S., F.C.S., and J. H. GILBERT, Ph. D., F.R.S., F.C.S.

THE records of a field of 14 acres in which wheat has been grown without manure, and by different descriptions of manure, year after year for twenty successive seasons, without either fallow or a fallow crop, and in which the lowest produce was in the first year 15, and in the last  $17\frac{1}{4}$  bushels, and the highest in the first year  $24\frac{1}{4}$ , and in the last  $56\frac{1}{2}$  bushels, cannot fail to be of much interest at once to the practical farmer, to the economist, and to the man of science. Accounts there have been before, of the growth of wheat for many consecutive years apparently with great success, and without much evidence of exhaustion, on soils of admittedly extraordinary fertility; and the recent experience of the Rev. S. Smith, of Lois Weedon, has shown that, on his soil at least, many wheat-crops can be taken, under a system of alternate crop and fallow, without reaching, at any rate for many years, the point of deterioration. History also tells us of large tracts of land on which the wheat-crop has been cultivated year after year for many years, but which have eventually succumbed to the unnatural strain put upon them. The records to be laid before the reader in the present paper refer to conditions of growth like in some points, but essentially different in most, to those of the cases to which allusion is here made.

The experiments have been made upon what may be called fair average wheat-land. But, as the rental of similar land in the immediate locality ranges, and has ranged for many years past, only from 25s. to 30s. per acre, tithe free, and its wheat-crop under the ordinary management of the district certainly does not average more than from 25 to 27 bushels per acre once every five years, it is obvious that, in a practical point of view, it can lay no claim to extraordinary fertility, or to be ranked on a higher level than a large proportion of the soils on which wheat is grown with a moderate degree of success under a system of rotation and home manuring. Such, in an agricultural or commercial point of view, were the general characters of the land. Speaking still in agricultural language, it may be said that the soil is a somewhat heavy loam, with a subsoil of raw yellowish red clay, but resting in its turn upon chalk, which provides good natural drainage.

The questions arise:—What are the grain-yielding capabilities of such land?—what its powers of endurance?—in what constituents, or class of constituents, does it soonest show signs

of exhaustion?—and how far will the answers arrived at on these points in reference to it, accord with, or be a guide to, those which would apply to any large proportion of the arable land of Great Britain when farmed in the ordinary way, with rotation?

When this Journal first appeared, now five-and-twenty years ago, such questions as these were hardly thought of, excepting by a few philosophers and economists whose speculations were scarcely heard of, and still less heeded, by any considerable number even of the most intelligent of agriculturists. Since that period, however, matters have very much changed; and the history of the change shows it to have been due to by no means one cause alone. Almost coincidently, or at any rate following very closely upon one another's footsteps, and each reacting upon the other, the increase of population, commercial freedom and competition, a vast increase in scientific knowledge, and extensive diffusion both of it and of information of a practical kind bearing upon the farmer's art, have contributed to the wide-spread spirit of enquiry of the present day on such subjects.

But it is especially to the laborious investigations on agricultural chemistry of Boussingault, and to the generalisations of Liebig to a great extent founded upon them, nearly a quarter of a century ago, that we must attribute much of the stimulus and direction that has been given to chemical enquiries in connexion with agriculture in recent times.

As bearing upon the plan adopted in our own experiments, it may be well very briefly to recall attention here, to the state of knowledge and opinion on some important points, about the time of their commencement, and during the earlier years of their progress.

Leaving out of view the many important preliminary points established by others, which were essential as a starting-point for Boussingault's researches, it may be stated that already before 1840, that indefatigable and most careful experimenter had determined, as far as the then known analytical methods permitted, the amounts of the most important constituents of agricultural produce put upon the land in the manure, and taken off in the crops, through several courses of rotation. His more important conclusions, stated in a very few words, were—that much more carbon and nitrogen were removed in the crops than were supplied in the manure; that the best rotations were those which accumulated the most of those constituents from the atmosphere; that some plants, especially Leguminosæ, accumulated more nitrogen from the atmosphere than others, and not only contained more in their removed produce, but by their residue left the land richer in nitrogen than it was before; and that the

value of manure was to a great extent measurable by the amount of nitrogen it contained.

In Liebig's first work on 'Organic Chemistry in its applications to Agriculture and Physiology,' published in 1840, he illustrated, more pointedly than Boussingault had done, the importance of the incombustible or ash-constituents; which, to distinguish them from carbonic acid, water, and ammonia, from which the organs of plants were in great part formed, he designated as "inorganic" substances. He, at the same time, also insisted strongly upon the importance of the nitrogen, or ammonia-yielding matter, of manures.

Soon after the appearance of Liebig's work, Boussingault published, much more fully, the results of his own agricultural investigations, and the conclusions deducible from them, bringing out more prominently his views as to the importance, in a practical point of view, of the nitrogen in manures.

Liebig followed with a new edition in 1843, in which he criticised Boussingault's experiments; condemned his notion of the relative importance of the nitrogen of manures; maintained (in direct opposition to the view put forward in his former edition) that the atmosphere afforded a sufficient supply of nitrogen for cultivated as well as for uncultivated plants; argued that this supply was sufficient for the cereals as well as for the Leguminous plants; that it was not necessary to supply nitrogen to the former; and insisted very much more strongly than formerly on the relative importance of the incombustible, or, as he designated them, the "inorganic" or "mineral" constituents. He even went so far as to say:—

"Is fertility not quite independent of the ammonia conveyed to the soil? If we evaporated urine, dried and burned the solid excrements, and supplied to our land the salts of the urine, and the ashes of the solid excrements, would not the cultivated plants grown on it—the gramineæ and leguminosæ—obtain their carbon and nitrogen from the same sources whence they are obtained by the gramineæ and leguminosæ of our meadows?"

"There can scarcely be a doubt with regard to these questions, when we unite the information furnished by science to that supplied by the practice of agriculture."—3rd Ed., p. 204.

Again—

"The crops on a field diminish or increase in exact proportion to the diminution or increase of the mineral substances conveyed to it in manure."—3rd Ed., p. 211.

Somewhat later, he said—

"It has been demonstrated that ammonia is a constituent part of the atmosphere, and that as such it is directly accessible and absorbable by all plants. If, then, the other conditions necessary

to the growth of the plants be satisfied—if the soil be suitable, if it contains a sufficient quantity of alkalis, phosphates, and sulphates, nothing will be wanting; the plants will derive their ammonia from the atmosphere, as they do carbonic acid. We know well that they are endowed with the faculty of assimilating these two aliments; and I really cannot see why we should search for their presence in the manures we use.”

“ . . . . The question of the necessity for ammonia in our manures resolves itself into the question of the necessity for animal manures, and upon the solution depends the entire future prospects of agriculture; for as soon as we can dispense with bulky farmyard manure, by the use of artificial preparations, the productive power of our fields is placed in our own hands.”

Our former papers published in this Journal have shown that the results of direct experiment, as well as the general experience of agriculture as practised in this country, are in the main confirmatory of the conclusions of Boussingault, and condemnatory of those of Liebig, as above quoted; and the records of continued investigation given in this paper will afford further evidence in the same direction, in reference to some of the points in question.

In his more recent works, however, Baron Liebig substantially affirms much of what we have from time to time maintained in correction of his own special doctrines. One example will suffice. In his most recent work—‘The Natural Laws of Husbandry’—in the course of a good deal of illustration bearing upon the point, he says:—

“It is easy to see that the accumulation of nitrogenous food by farmyard manure in the uppermost layers of the ground, so very important for the perfect growth of cereal plants, must chiefly depend upon the successful growth of fodder plants.”

Here, then, in direct contradiction to the views embodied in the sentences above quoted from his earlier writings, Baron Liebig now maintains the importance of the growth of fallow crops as a means of providing nitrogenous manures for the growth of the cereal grains. He does so, however, not only without any acknowledgment of previous error on the point, but, as in other instances, seeks to cover his change of view by putting forth his present opinions as apparently only the necessary consequences of general or abstract principles laid down by himself, and by misrepresentation and ridicule of those whose corrections he adopts.

Prior to the appearance of Baron Liebig’s work in 1840, numerous experiments, to a great extent suggested by a study of De Saussure’s researches on vegetation, had been made, on a



small scale, at Rothamsted, on the effects of various mineral and other substances when applied as manure to a variety of agricultural plants. The most marked result observed in these early trials was the very striking increase in the rapidity of growth of certain plants when earthy phosphates decomposed by sulphuric acid were employed.

In 1843, it was decided to make experiments at once more systematic and on a larger scale, on some of the most important crops of our rotations, to determine, as far as possible, the relative or characteristic dependence of each, on the soil, the atmosphere, and manure. Boussingault's researches had been designed to ascertain what constituents were furnished, respectively by the soil, the atmosphere, and manure, to the aggregate of crops forming a rotation, rather than to each description of plant individually; and he himself says that his plan and results were silent on the latter point, though there is no doubt they did, at the same time, afford some very trustworthy indications in relation to it.

Of the new series of experiments made at Rothamsted, the first commenced was on turnips; and in accordance with the results previously obtained on a small scale, and apparently quite consistently with the views put forth by Liebig as to the relative importance of supplying the mineral constituents, the effects of the phosphatic manures were most striking, especially in the early stages of growth; though, when the experiments of the first year were concluded, it was found that certain organic manures had very materially influenced the final amount of produce.

For the experiments upon wheat, a field of 14 acres was selected, which had grown turnips, barley, peas, wheat, and oats, since the application of manure, and would, therefore, according to the ordinary rules of practice, be considered so far exhausted as to require to be re-manured before growing another crop.

It was thought that a field in such a condition was peculiarly fitted to show in which of the constituents of the crop to be grown the soil had become practically the most deficient by the removal of the five preceding crops; and that, if, on some plots of the land, in this agricultural sense exhausted, certain constituents of farmyard manure were supplied separately, on others in combination, and if, on others by their side, the crop were grown respectively without manure, and with farmyard manure itself, the comparative results obtained would far more satisfactorily indicate what constituents were the most exhausted, so far as their available supply for the crop to be grown was concerned, than any analysis of the soil could do.

This view has been fully confirmed, not only by the results obtained on the plan adopted, but by those obtained by others

who have attempted to determine on what depends the productive condition of a soil, by means of the chemical analysis of soils of different physical characters, and of known different productive qualities. The opinions of Professor Magnus, put forth some years later, in his report upon forty-two analyses of soils made under the auspices of the Landes-Oekonomie Kollegium of Prussia, to which he was then chemist, abundantly confirm the propriety of the decision at which we arrived, after a very careful consideration of the subject at the commencement of our experiments.

Our conclusion, as indicated in former papers, and frequently expressed in answer to the objections of chemical friends who had not paid special attention to the applications of chemistry to agriculture, was, that far more had yet to be done in determining the chemical and physical qualities of soils in relation to the atmosphere, and to manurial substances exposed to their action, as well as in perfecting methods of analysis, before comparative analyses could aid us much in deciding upon the relative productiveness of different soils, to say nothing of the still more difficult problem of estimating, by such means, the condition of fertility or exhaustion of one and the same soil at different times. Of late years very much has been done in these departments of investigation; still, as recent discussions abundantly show, far too little is even yet known of what a soil either is or ought to be, in a chemical point of view, to render the results of the analysis, of soils directly applicable to the solution of questions such as those we had in view in our enquiry. But if our knowledge of the chemistry of soils should progress as rapidly as it has during the last twenty years, the analysis of a soil will ere long become much more significant than it is at present.

In the mean time, therefore, the synthetic rather than the analytic method was relied upon. And it was with the striking effects of the mineral manures upon the still growing turnip-crop under our view, and wishing to test more fully the recently-promulgated doctrines of Liebig, that the plan of the first of the twenty years of experiments with wheat was arranged. Under the influence of such experience, and of such theoretical considerations, "inorganic" or "mineral" manures of some kind were applied to almost every plot, and nitrogenous ones to very few. Without anticipating in these preliminary remarks the results which will be given in detail further on, it may be stated generally, that in this first season scarcely any increase whatever was obtained from the exclusive application of any of the so-called mineral manures; whilst, wherever nitrogenous manures were employed the effect was very striking.

Naturally enough much more nitrogen (as ammonia or in some

other available form) was employed in subsequent seasons; and so marked have been its effects, that the interest of the investigation may be said almost to begin and end with the consideration of the influence of that important constituent of manures on the amounts and character of the produce obtained, in immediate or succeeding crops, according to the quantity employed, to the condition of the land in regard to the supply of available mineral constituents, and to the characters of the seasons.

### THE FIELD EXPERIMENTS.

The particulars of the manuring and produce of each of the experimental plots, in each of the twenty years over which the experiments have extended, are given in detail in Tables I. to XXI. inclusive, in the Appendix; and in Tables XXII. to XXVI. inclusive, also in the Appendix, are given some of the most important results in a more collective form. Those voluminous records, as above classified, show, respectively, the effects of one manure compared with another in each season separately, and the great difference of effect of the same manure in one season compared with another, and its increasing or diminishing effect when used year after year on the same plot.

It will be obvious, however, on a very little reflection, that the question of the relative condition of exhaustion of the different plots cannot be satisfactorily considered by reference to the amounts of crop alone. To deal adequately with this part of the subject, the consideration of the chemical composition, as well as the amount, of the produce is obviously essential. Accordingly, the proportions of dry substance, and of mineral matter, in both the corn and the straw, of each plot, in each of the twenty years, have been estimated. The proportion, and amount per acre, of the nitrogen, and the composition of the ash, in both corn and straw, have in many selected cases been determined. The percentage of nitrogen in the soil of some of the plots, at different stages of the progress of the experiments, has also been estimated. The mere tabular record of these results of analysis would occupy nearly as much space as those relating to the experiments in the field; whilst the discussion of them, in their manifold and important bearings, would supply matter more than sufficient for a single paper. It is proposed, therefore, on the present occasion, to leave out of view the analytical results altogether, and to confine attention, almost exclusively, to the more salient points of interest brought out by the results of the field experiments alone, leaving the detailed treatment of the question of exhaustion to a future opportunity.

The question of the climatic characters of the different seasons, and of the connexion between these and the amount and character of the produce yielded, would also require, for its due illustration



and elucidation, the discussion of such a vast amount of meteorological record, and is, moreover, one of such intricacy, that it would be impossible to treat it at all satisfactorily within the limits that might otherwise have been devoted to so interesting and important a branch of the subject in the present paper. The consideration of the influence of season will, therefore, on the present occasion, be limited to pointing out, as matters of fact, the most prominent characteristics of the respective seasons, and the very great difference in the amounts and in the characters of the produce obtained under otherwise comparable conditions of growth, but in different seasons.

Incidentally, however, the results brought out under this head will enable us to form some judgment as to whether the earlier or the later seasons of the experiments were, upon the whole, the less or the more favourable; and, therefore, whether an increased or diminished result from the use of the same manure through successive years, is to be attributed mainly to the cumulative or the defective character of the manure itself, or, in any material degree, to a progressive or retrogressive character of the seasons.

#### *General Description of the Manures employed.*

Having regard to the constituents of the ash of wheat-grain, and of wheat-straw, it was sought to supply potass, soda, lime, magnesia, phosphoric acid, sulphuric acid, chlorine, and silica, respectively, in the most available and convenient forms. Omitting from the enumeration the amounts of mineral constituents provided in farmyard manure, cut wheat-straw, rape-cake, &c., or in the ashes of farmyard manure or wheat-straw, the more direct supply of the above-mentioned substances was as under:—

*Potass*—As pearl-ash, sulphate of potass, or silicate of potass.

*Soda*—As soda-ash, or sulphate of soda.

*Lime*—As sulphate, phosphate, and superphosphate.

*Magnesia*—As magnesian lime-stone, or sulphate of magnesia.

*Phosphoric Acid*—As bone-ash; generally acted upon by sulphuric acid in quantity sufficient to convert a considerable portion of the insoluble earthy phosphate of lime into sulphate and soluble superphosphate of lime.

*Sulphuric Acid*—As sulphate of potass, soda, or magnesia, in the phosphatic mixture last mentioned, &c.

*Chlorine*—As hydrochloric acid (with bone-ash), or as chloride of sodium (common salt), &c.

*Silica*—As artificial silicate of potass; formed by fusing together equal parts of sand and pearl-ash.



In accordance with the nomenclature employed by Liebig, and generally adopted by writers on agricultural chemistry, all the above are, for convenience, distinguished as "inorganic" or "mineral" manures. Professor Hofmann\* has, however, recently suggested the term *cinereal* (from *cineres*, ashes) to designate those constituents which are found in the ashes of plants. Although, undoubtedly, far more appropriate than the terms "inorganic" or "mineral," the attempt to substitute it now would be fraught with more inconvenience and confusion than advantage. Liebig himself, has, indeed, of late, sought to repudiate the use of the term *mineral* in the restricted sense in which he had habitually used it in agricultural discussions. He has even attempted, by means of direct misquotation, to fix the origination of the distinction upon ourselves.†

Other constituents have been supplied as under:—

*Nitrogen*—As sulphate, muriate, or carbonate of ammonia, or nitrate of soda, of commerce; in farmyard manure, and in nitrogenous organic matter, such as rape-cake, &c.

*Non-nitrogenous organic matter, yielding by decomposition carbonic acid, and other products*—In rape-cake, rice, tapioca, and also in straw and in farmyard manure.

The artificial manure or mixture for each plot, was generally ground up with a sufficient amount of clay-ashes to make it up to such a fixed measure per acre as would facilitate its equal distribution over the land. In the earlier years the mixtures so prepared were sown broadcast by the drill; but they have for some time past, with proper precautions, been distributed by hand, as it was found that in that way the application of an exact amount of manure to a limited area of land could be best accomplished. Now, however, a drill has been constructed expressly for the purpose of the application of the experimental manures.

The field of 14 acres was at first divided into plots of which most consisted of two lands (each about 12 feet 5 inches wide) running the whole length of the field, and comprising together nearly two-thirds of an acre. After the second season, however, the double-land plots were each divided into two; though, in most cases, the two were similarly manured, thus providing duplicate experiments with the same manure.

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\* 'Reports of the Juries' of the International Exhibition of 1862; footnote, pp. 159, 160. Professor Hofmann has also, in his capacity of International Reporter, passed a judgment on the controversy between Baron Liebig and ourselves; fortunately, however, Baron Liebig's own works, and our own papers in this Journal, and elsewhere, remain in enduring protest against his misstatement of the issues, and his caricature of our own opinions.

† For further evidence on this point, see footnote at pp. 506-8 in the last number of this Journal; also pp. 447, 448, and context, Vol. xvi.

In the earlier years of the experiments the manures were each season allotted with a view to the settlement of certain individual points; such, for instance, as the effect of individual mineral manures, the necessity or otherwise of providing carbonaceous organic matter, and the effect, on the one hand of a deficient or partial, or on the other, of a full or excessive, manuring in one season on the crop of the immediately succeeding season. The allotment was always made with more or less of special reference to the previous manuring and produce of the respective plots; but, unfortunately, not with that full appreciation of the desirableness of maintaining exactly and easily comparable relations between one plot and another for a long series of consecutive seasons, which, in this hitherto untrodden path of inquiry, could only be attained by a careful study of the results from time to time obtained.

The manures applied on one and the same plot were, indeed, much more uniform from year to year after the first three, or even in many cases after the first two years of the experiments. There were, however, still some variations in the description, and more in the amount employed on the same plot, even up to the eighth year inclusive; though, during the last four of these, there were comparatively few the effect of which would be to interfere materially with the comparative character of the results obtained in subsequent seasons.

In the ninth year it was definitively arranged to supply, throughout the field, the same manure year after year, on the same plot, for many successive seasons, so as to trace more clearly the point at which one or another constituent became exhausted, or in excess, in relation to others, or to the requirements for the production of a maximum crop.

It is obvious, therefore, that when comparing the results obtained on one plot with those of another in the ninth and eleven succeeding seasons, the previous history of each plot must be taken into consideration. Numerous illustrations will, indeed, be given of the effects of the unexhausted residue of nitrogenous and mineral manures applied in preceding seasons, on the amounts of produce obtained in succeeding ones; not only, however, with a view to the more correct interpretation of the results obtained in the later years of these experiments, but also on account of the great practical importance of the question. But it will be when we come, on a future occasion, to discuss the deficiency or excess of certain constituents by the aid of analysis, that we shall enter more fully into the chemical statistics of each individual plot than is necessary, or even desirable, in presenting the outline of the results in their more practical bearings which it is proposed to give in the present paper.

### THE FIELD RESULTS.

In former numbers of this Journal (vol. viii. part 1; vol. xii., part 1; and vol. xvi., part 2), the most important of the results obtained in the earlier years have been discussed; and to those papers, and to the detailed records given in the Appendix Tables at the conclusion of this paper, the reader is referred for any more than the very brief notice of the experiments of the first eight years which can now be given.

On the present occasion the results of the whole 20 years will be treated of under the following separate heads:—

First.—*Amount and character of the produce obtained under the different conditions of manuring, in each of the 20 years; with brief reference to the characters of each season.*

Second.—*Effects of the unexhausted residue from previous manuring (both nitrogenous and mineral) upon succeeding crops.*

Third.—*Average annual result over the last 12 years, by each description of manure applied year after year on the same plot.*

Fourth.—*Amount of ammonia in manure required to yield one bushel increase of grain (with its proportion of straw), according to the quantity applied per acre, to the available supply of mineral constituents within the soil, and to the season.*

Fifth.—*Concluding observations; showing the practical bearings of the results.*

#### I.—AMOUNT AND CHARACTER OF THE PRODUCE OBTAINED IN DIFFERENT SEASONS.\*

##### *First Season, 1843-4.*

The winter of 1843-4 was unusually mild until the end of January. February and March were cold, wet, and stormy. April and May were unusually dry, with some warm weather, but a good deal of cold easterly wind. June was variable as to temperature, with scarcely any rain throughout the greater part of it, but a good deal towards the end of the month. July was wet, but with more than the average temperature, especially during the last week. August was almost throughout colder than usual, and excepting towards the end, windy and wet. In September a moderate amount of rain fell, but the weather was, upon the whole, warm and favourable. The dew-point and the degree of humidity of the air were, in June below, and in July about the average; in August the dew-point was low, but with the prevailing low temperature the degree of humidity was high; and in September both dew-point and degree of humidity were above the average.

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\* The references to the characters of the seasons, and of the wheat-crops of the country, may be taken as applicable, so far as such brief and general statements can be, to a considerable portion of the Midland, Eastern, and Southern counties of England.

With these characters of season, which proved extremely adverse to grass and spring-sown crops, the wheat-crop was reported to be generally well got in, and to be one of the largest in bulk and yield for many years past.

The amount and character of the produce obtained in the experimental field is sufficiently indicated by the following summary of the results yielded on some of the most important plots:—

TABLE I.—SUMMARY of the Results of the FIRST SEASON, 1843-4.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	15	0	58·5	923	1120
14 tons Farmyard Manure (Plot 2) .. .. .	20	1 $\frac{3}{4}$	59·3	1276	1476
Ashes of 14 tons Farmyard Manure (Plot 4) ..	14	2 $\frac{1}{2}$	58·0	888	1104
Mixed Mineral Manure alone; mean of 9 plots (5, 6, 7, 8, 10, 12, 13, 14, and 15) .. .. .	15	2 $\frac{3}{4}$	61·0	1009	1155
Mixed Mineral Manure, and 65 lbs. Sulphate of Ammonia; mean of 3 plots (9, 16, and 17) ..	19	1 $\frac{3}{4}$	62·3	1275	1423
Mixed Mineral Manure, and 80 lbs. Sulphate of Ammonia (Plot 19) .. .. .	24	1 $\frac{1}{4}$	61·8	1580	1772

It will be observed that notwithstanding the very favourable report of the year's crop, the produce in these experiments was, without manure only 15 bushels, and with farmyard manure scarcely 20 $\frac{1}{2}$  bushels of dressed corn, with proportionally small amounts of straw. These low results afford satisfactory evidence that the land was in a condition of practical or agricultural exhaustion; and hence, that it was well fitted for the purpose of experiments the object of which was to show in what constituent, or class of constituents, the soil had become, by the previous course of cropping, the most deficient, so far as the requirements of the wheat-crop were concerned.

It is specially worthy of remark, too, that on land in this condition, the ashes, or mineral constituents, of farmyard dung, gave no increase whatever, and artificial mineral manures did so to the amount of less than a bushel of dressed corn, and only 35 lbs. of straw. On the other hand, mineral manure and only 65 lbs. of sulphate of ammonia per acre, gave nearly as much produce as the farmyard manure; whilst one experiment, in which 80 lbs. of sulphate of ammonia were employed with mixed mineral manure, gave the highest produce obtained in that year, and nearly 4 bushels of corn, and 300 lbs. of straw, more than was yielded by the farmyard manure.



The obvious conclusion was, that, by the ordinary course of cropping to which the land had been subject, the soil had become deficient in available nitrogen relatively to the available supply of mineral constituents required by the wheat-plant.

*Second Season, 1844-5.*

November, 1844, was comparatively warm, with a good deal of rain. December was unusually severe throughout. January (1845) was very wet and mild. February and the greater part of March were extremely cold, the thermometer on several occasions showing lower temperatures than had been observed for many years, and at intervals a good deal of snow fell. April was cold, but, upon the whole, dry; and May was cold, wet, and unseasonable. In June not much rain fell, and the weather was pretty warm throughout; but July and August were generally both cold and wet. September, too, was cold throughout, with an excess of rain during the latter half of the month. In June, the dew-point was considerably above, in July about, and in August and September somewhat below the average; but, in each of these months, the degree of humidity of the air was notably above the average.

The wheat-crop of 1845 was generally deficient in bulk, yield, and quality. It was in this season that the potato disease first appeared to any extent.

The following is a summary of the results obtained in the experimental field:—

TABLE II.—SUMMARY of the Results of the SECOND SEASON, 1844-5.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.			Total Corn.	Straw and Chaff.
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	23	0 $\frac{3}{4}$	56·5	1441	2712
14 tons Farmyard Manure (Plot 2) .. .. .	32	0	56·8	1967	3915
2 cwts. Carbonate of Ammonia (top-dressed in solution), Plot 5 <sup>2</sup> .. .. .	26	3 $\frac{3}{4}$	57·3	1732	3599
3 cwts. Ammonia-salts (equal parts Sulphate and Muriate); mean of 2 plots (9 and 10) .. }	32	2 $\frac{1}{2}$	57·3	2056	4162
2 cwts. Ammonia-salts (equal parts Sulphate and Muriate) and Superphosphate of Lime (plot 18) .. .. .	33	0 $\frac{1}{4}$	56·5	2048	3819
2 cwts. Sulphate of Ammonia, 5 cwts. Rape- cake, and Mineral Manure; mean of 3 experi- ments (plots 1, 11, and 12) .. .. .	28	2 $\frac{1}{4}$	55·3	1804	3979

Owing to the very unfavourable winter of 1844-5, severe frost

alternating with a great deal of rain, it was impossible to prepare the land and sow the manures and seed in the experimental field until March, 1845; and, as the above statement shows, the period from seed-time to harvest was, with the exception of June, almost uniformly cold, wet, and unseasonable. Further, as already referred to, mineral manures were applied on very few, and ammonia-salts, or rape-cake, on most of the plots.

As above stated, the wheat-crop of the country was reported to be generally deficient in quantity as well as quality; but in the experimental field, although the quality, as indicated by the weight per bushel, and the proportion of corn to straw, was low, the bulk and weight of total produce were above the average of the 20 years under comparable conditions of manuring. Indeed, both without manure, and with farmyard manure, the produce of corn was about  $1\frac{1}{2}$  time, and that of straw about  $2\frac{1}{2}$  times as much as in the reputedly very much more favourable season of 1844.

The produce without manure being  $23\frac{1}{4}$  bushels, and that by farmyard manure 32 bushels, 3 cwts. of ammonia-salts per acre (succeeding a mineral manure in the previous season) gave  $32\frac{1}{2}$  bushels of corn and 4162 lbs. of straw, or more both of corn and straw than the 14 tons of farmyard manure; whilst only 2 cwts. of ammonia-salts per acre, but used in conjunction with mineral manure (plot 18), gave even rather more corn, and not much less straw.

It is unfortunate that mineral manure was in no case used alone in this season. But the effects of ammonia-salts, as in the preceding season, are very striking. It is also seen, by a comparison of the result of 2 cwts. of ammonia-salts with mineral manure, with that of 3 cwts. without it (though succeeding mineral manure in the previous season), that the mineral constituents supplied, though so inactive when used alone in the preceding year, had a very marked effect when a sufficient amount of ammonia was at the same time provided within the soil. The influence of the mineral manure was, moreover, very much to increase the tendency to the production of corn rather than of straw.

### *Third Season, 1845-6.*

Throughout the winter of 1845-6 the temperature was generally above, and sometimes considerably above, the average. In December and January there was a great deal of rain, but in November and February less than the average. The first part of March, too, was considerably warmer than usual, with little rain. It then became colder, and towards the end of the month there was frost and snow. The beginning and end of April were

rather cold, but otherwise the month was mild, with a good deal of rain. May was very fine, the temperature being much above, and the rain-fall much under the average. June was very unusually hot and dry until towards the end of the month, when the weather broke up with a thunder-storm. July was variable, but, upon the whole, seasonable, with a good deal of very hot weather, and but little rain. In the beginning of August there was great heat with heavy thunder-storms, and excessive amount of rain, the rest of the month being favourable. September was also generally warm and favourable, but with a fair amount of rain towards the end of the month. The dew-point generally ranged high throughout June, July, August, and September; but, with the prevailing high temperatures, the degree of humidity of the air was, in June and July somewhat below, and in August and September not much above the average.

Upon the whole, the winter, spring, and summer of 1845-6 were unusually warm, the summer dry, and the harvest-time generally favourable.

With these qualities of season, the wheat-crop of the country was estimated to be below the average in amount, but to be of very good-quality.

In the experimental field mineral manures were employed more generally, in greater variety, and in greater abundance, than in the preceding season. Ammonia-salts, or rape-cake, or both, were also used on many of the plots. Among the mineral manures, the ashes of wheat-straw, and Liebig's wheat-manure, were respectively employed alone, with ammonia-salts, with rape-cake, and with both ammonia-salts and rape-cake. Upon the whole, there was more of uniform plan in the selection and arrangement of the manures in this season than formerly; and, as already referred to, the double-land plots were now, and henceforth, subdivided; though, especially in the later years of the experiments, the two lands designated *a* and *b* respectively, generally served as duplicates with the same manure. Passing over all details, Table III. (p. 108) is a summary of the results obtained in this season.

The experimental wheat-crop of 1846 was by no means so bulky as that of 1845; but (as also over a large area of the country) the quality was very much above the average, both the proportion of corn to straw, and the weight per bushel of dressed corn, being very high.

Taking the unmanured produce of dressed corn as the standard for comparison, the farmyard manure gave an increase of  $9\frac{1}{2}$  bushels; mineral manure alone (though succeeding ammonia-salts or rape-cake, or both, in the preceding season), of under 3 bushels; 2 cwt. of sulphate of ammonia alone (after ammonia-salts in the preceding year, and mineral manure

TABLE III.—SUMMARY of the Results of the THIRD SEASON, 1845-6.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3). . . . .	17	3½	63·8	1207	1513
14 tons Farmyard Manure (Plot 2) . . . . .	27	0¼	63·0	1826	2454
Mixed Mineral Manures; mean of 4 experi- ments (Plots 1, 5a <sup>1</sup> , 6a, and 18b) . . . . .	20	3	63·0	1422	1766
2 cwts. Sulphate of Ammonia alone (Plot 10a) . . . . .	27	1½	63·6	1850	2244
2 cwts. Ammonia-salts (equal parts Sulphate and Muriate), and Mixed Mineral Manure; mean of 9 experiments (Plots 5a <sup>2</sup> , 6b, 8b, 11b, 12b, 13b, 14b, 17b, and 18a) . . . . .	29	0¼	63·2	1965	2626
4 cwts. Rape-cake, and Mixed Mineral Manure; mean of 8 experiments (Plots 5b <sup>1</sup> , 7a, 8a, 11a, 12a, 13a, 14a, and 16a) . . . . .	23	2½	63·2	1603	2047
2 cwts. Ammonia-salts (equal parts Sulphate and Muriate), 4 cwts. Rape-cake, and Mixed Mineral Manure; mean of 4 experiments (Plots 5b <sup>2</sup> , 7b, 16b, and 17a) . . . . .	31	2	63·1	2125	3006

in the year before that), 9½ bushels; 2 cwts. of ammonia-salts and mineral manure, rather over 11 bushels; 4 cwts. rape-cake and mixed mineral manure, 5¾ bushels; and 2 cwts. ammonia-salts, 4 cwts. rape-cake, and mixed mineral manure, 13½ bushels.

Thus, under the influence of this hot and dry summer, the ammonia-salts alone gave rather more corn, and not much less straw, and the ammonia-salts and mineral manure together more of both corn and straw, than the farmyard manure; whilst mineral manures alone gave very much less produce than ammonia-salts alone. Here again, then, in a very different season, and in the third of the growth of wheat on the same land, the inefficiency of mineral manures alone, and the marked effect of nitrogenous manures, are very striking.

#### Fourth Season, 1846-7.

Until the end of November, 1846, the season was mild and favourable. December, January, February, and considerable part of March, were extremely cold, with intense frosts, and much fog, and, towards the end of February, deep snow; January was, however, less rigorous than the other months. The remainder of March, the whole of April, and the early part of May were still unusually cold, with but little rain until towards the end of April, after which there was a good deal. The latter part of May and the beginning of June were fine, with a good deal of high temperature; but during the latter part of June more than the usual amount of rain fell, and the temperature was also below the



average. July was, upon the whole, fine, sometimes excessively hot, with little distributed rain, but a good deal in a heavy thunderstorm towards the end of the month. In August, again, not much rain fell, but it was distributed over the whole month. September was showery, windy, and generally of rather low temperature, but still, upon the whole, favourable. In June, both dew-point and degree of humidity of the air were rather below the average; in July the dew-point was above, but the degree of humidity below the average; in August, both dew-point and degree of humidity were considerably above the average; and in September the dew-point was low, but with the prevailing low temperatures the degree of humidity was rather high.

Both the yield per acre, and the quality of the grain, of the harvest of 1847, were reported to be generally above the average.

In the experimental field mineral manures were in no case employed alone in this season; neither potass, soda, nor magnesia was used. Superphosphate of lime was applied in smaller quantity than in the preceding year, but on nearly the same plots; ammonia-salts in rather larger quantity; and rape-cake not at all; but rice, as a means of supplying decomposing organic matter containing much less nitrogen than rape-cake, was applied in a few instances in large quantity per acre. The following is a summary of the most characteristic results:—

TABLE IV.—SUMMARY of the Results of the FOURTH SEASON, 1846-7.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	16	3½	61·0	1123	1902
14 tons Farmyard Manure (Plot 2) .. .. .	29	3¾	62·3	1981	3628
300 lbs. Ammonia-salts (equal parts Sulphate and Muriate); mean of 8 experiments (Plots 6a, 6b, 7a, 7b, 9a, 9b, 10a, and 10b) .. .. .	25	3¼	61·6	1711	2921
300 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Superphosphate of Lime; mean of 14 experiments (Plots 5a, 11a, 11b, 12a, 12b, 13a, 13b, 14a, 14b, 16a, 16b, 17a, 18a, and 18b) .. .. .	29	3¼	62·3	1991	3502
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Superphosphate of Lime; mean of 2 experiments (Plots 8b and 17b) .. .. .	33	0½	61·9	2167	3991
300 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Superphosphate of Lime, and 500 lbs. Rice; mean of 2 experiments (Plots 5b and 8a) .. .. .	32	2	61·7	2124	3702
20 cwt. of Rice alone (Plot 9a <sup>1</sup> ) .. .. .	22	3	..	1351	2506

Although the wheat-crop of 1847 was reported to be generally above the average, both as to yield per acre and quality, there was here, except in the case of the farmyard manure, not quite so much corn for a given amount of manure applied, nor was the weight per bushel so high, as in the preceding year. The amount of straw was, on the other hand, much greater; though, neither was it, nor that of the corn, equal to the average of the years of experiment. The quality of the grain, as indicated by the weight per bushel, was, however, considerably above the average.

By farmyard manure there was an increase over the unmanured produce of 13 bushels of corn, and 1726 lbs. of straw; and there was very nearly the same amount by 300 lbs. of ammonia-salts together with superphosphate of lime. Without the superphosphate of lime the ammonia-salts show a deficiency of nearly 4 bushels of dressed corn, and of 581 lbs. of straw. 400 lbs. of ammonia-salts with superphosphate of lime gave 33 bushels of dressed corn per acre, or an increase over the unmanured produce of about 16 bushels, and over that by farmyard manure of rather over 3 bushels of corn and of 363 lbs. of straw. By the substitution of 100 lbs. of ammonia-salts by 500 lbs. of rice, the quantity of both corn and straw was somewhat reduced; and by the use of 1 ton of rice alone, the total increase obtained was little more than one-third the weight of the manure employed.

Here again, then, in the fourth season, ammonia-salts alone gave a very considerable amount of increase, and when used in conjunction with superphosphate of lime the largest produce of the season was obtained.

#### *Fifth Season, 1847-8.*

November, December, January, and February of the winter of 1847-8 were, upon the whole, fine and mild, though there was some excessively cold weather, with dry piercing winds, sharp frosts, and snow towards the end of January and beginning of February, and during the remainder of the latter month a great deal of rain, but with comparatively high temperature. March and April were very wet and cold, excepting at the end of the former and the beginning of the latter month, when the weather was finer and warmer. May was genial, with little rain. June and July were unseasonably wet, variable as to temperature, with a good deal of cool, and but little hot weather. August also was unsettled, generally cold, and extremely wet. September was variable with some fine and hot days, but a good deal of wind and low temperature, and towards the end a good deal of rain. In June, July, August, and September, the dew-point ranged rather below the average, more particularly in August;

and the degree of humidity of the air was, in June and August slightly above, and in July and September slightly below the average.

With such prevalence of cold and wet weather during the growing and ripening period, the wheat-crop of 1848 was reported to be very deficient both in quantity and quality.

The manuring in the experimental field was generally heavier than in the preceding year. Salts of potass, soda, and magnesia, were again employed on many plots; the amounts of superphosphate of lime, and also of ammonia-salts, were generally larger; and the more highly nitrogenised rape-cake was employed instead of rice. The following is a summary of the results obtained under the above conditions of season and manuring:—

TABLE V.—SUMMARY of the Results of the FIFTH SEASON, 1847-8.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.			
	Dressed Corn.		Total Corn.	Straw and Chaff.
	Quantity.	Weight per Bushel.		
	Bush.	Pks.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	14	3	57.3	952
14 tons Farmyard Manure (Plot 2) .. .. .	25	2 $\frac{3}{4}$	58.2	1705
Mineral Manure alone; mean of 4 experiments (Plots 0, 8a, 8b, and 9a) .. .. .	19	0 $\frac{3}{4}$	57.7	1243
300 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Plot 10a .. .. .	19	1	58.1	1334
300 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure; mean of 4 experiments (Plots 9b, 10b, 18a, and 18b) ..	25	3 $\frac{1}{2}$	58.7	1703
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure; mean of 8 experiments (Plots 6a, 6b, 11b, 12b, 13b, 14b, 17a, and 17b) .. .. .	26	1 $\frac{1}{4}$	58.6	1763
500 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure (Plot 5a) }	29	3 $\frac{1}{2}$	59.2	1991
300 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Mineral Manure, and 500 lbs. Rape-cake; mean of 8 experiments (Plots 7a, 7b, 11a, 12a, 13a, 14a, 16a, and 16b) .. ..	29	2 $\frac{3}{4}$	59.1	1941
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Mineral Manure, and 500 lbs. Rape-cake (Plot 5b) .. .. .	30	3 $\frac{1}{2}$	59.1	1932

With such unfavourable characters of season, the produce in the experimental field agreed with that of the wheat-crop of the country generally in being inferior both in quantity and quality. Although the manuring, both mineral and nitrogenous, was generally heavier than in 1847, or, indeed, than in any preceding season, the amount of produce was considerably less than in either 1847 or 1846, and the weight per bushel of

the grain was also considerably lower. The deficiency was not only in amount and quality of grain, but, compared with 1847, in quantity of straw also. The defective action of ammonia-salts when used without mineral manure was already observable in the results of 1847, and it is still more marked in those of 1848. Finally, 500 lbs. of ammonia-salts, in combination with mineral manure containing not only superphosphate of lime, but also potass, soda, and magnesia, gave only about the same amount of grain in the inferior season of 1848, as 300 lbs. with superphosphate of lime in 1847, or even 2 cwts. with mixed mineral manure in 1846.

#### *Sixth Season, 1848-9.*

The early part of October was fine and mild, but the latter part cold, with much heavy rain and wind; the beginning of November was very dry and cold, but the remainder of the month, and most of December, were mild, with a good deal of rain; then frost set in, which lasted, with snow and rain, till nearly the middle of January, the remainder of which month was variable as to temperature, but generally very wet. February was, for the most part, fine and mild, until nearly the end of the month, when it was much colder, very wet, and very windy. March and April were cold, and a great deal of rain fell in the latter month. May was also very wet, but fine and warm at the close. June was fine and dry, but rather cold. July dry and hot until towards the end, when there were several heavy thunder-storms. August also was fine, with the exception of some thunder-storms. September variable, with a good deal of rain in the early part. In June, July, August, and September, the dew-point was\*below the average; and the degree of humidity of the air was, in June slightly, but in July, August, and September, considerably below the average.

Upon the whole, then, the winter and spring of 1848-9 were mild, with a good deal of rain, and the summer and autumn, with some exceptions, seasonable and warm. The wheat-crop of the season was reported to be very abundant.

The manuring for the sixth season was much the same as for the fifth; the chief alteration being the substitution of 400 lbs. of ammonia-salts in most cases where 300 lbs. of ammonia-salts and 500 lbs. of rape-cake had been used in the preceding year.

With generally favourable weather throughout, and dry and warm weather before and about the time of harvest, the result in the experimental field, as in the country generally, was a wheat-crop above the average, both as to quantity and quality. The amount of produce for a given amount of manure was more than in 1848, 1847, or even 1846. The weight per bushel of dressed



corn was rather higher than in any other year of the experiments; and the proportion of corn to straw was much above the average, being about the same as in 1846 and 1857, the years of highest yield of corn in proportion to straw throughout the 20 years, 1844 excepted, when it was unusually high, but when, in these experiments, the total amount of produce was very small.

TABLE VI.—SUMMARY of the Results of the SIXTH SEASON, 1848-9.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	19	1	61·4	1229	1614
14 tons Farmyard Manure (Plot 2) .. .. .	31	0	63·8	2068	3029
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Plot 10a .. .. .	32	2½	62·3	2141	2851
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure; mean of 18 experiments (Plots 6a, 6b, 7a, 7b, 11a, 11b, 12a, 12b, 13a, 13b, 14a, 14b, 16a, 16b, 17a, 17b, 18a, and 18b) .. .. .	34	3	63·8	2318	3393
500 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure (Plot 5a) }	37	1½	63·1	2446	3589
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Mineral Manure, and 500 lbs. Rape-cake (Plot 5b) .. .. .	39	3½	63·4	2651	3824

The season of 1849 seems to have been particularly favourable for the action of nitrogenous manures; there being comparatively little deficiency where the ammonia-salts were used alone, as compared with the result with the same amount in conjunction with mineral manure; and the excessive amounts of ammonia gave proportionally larger amounts of increase than in most of the other seasons.

### Seventh Season, 1849-50.

The autumn of 1849 was generally favourable for getting in the seed. In the early part of December, and the latter part of January (1850) there was a good deal of rain, and, intermediately, pretty continued frost. February was fine and mild; March fine, but very cold; April very fine and seasonable until the last week, when it was much colder; and May cold and wet in the early part, but seasonable afterwards. June, July, August, and September, were almost throughout unseasonably cold; and there were occasional heavy rains in June and July, but during August, and the greater part of September, but little rain fell.

In June, August, and September, the dew-point was rather below, but in July rather above the average; and the degree of humidity of the air was in June considerably below, in July and August somewhat above, and in September somewhat below the average.

The harvest was late, the wheat-crops much laid, and the yield per acre was estimated to be below the average.

With few exceptions, which it is not necessary to notice here, the manures applied in the experimental field were much the same as in the two preceding seasons. The following is a summary of the results:—

TABLE VII.—SUMMARY of the Results of the SEVENTH SEASON, 1849-50.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	15	3 $\frac{1}{4}$	60·6	1002	1719
14 tons Farmyard Manure (Plot 2) .. .. .	28	2	61·9	1861	3245
Mineral Manure alone (Plot 0) .. .. .	19	1 $\frac{1}{2}$	60·8	1220	2037
400 lbs. Ammonia-salts alone (equal parts Sulphate and Muriate) Plot 10a .. .. .	26	3 $\frac{3}{4}$	60·2	1721	3089
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure; mean of 16 experiments (Plots 6a, 6b, 11a, 11b, 12a, 12b, 13a, 13b, 14a, 14b, 16a, 16b, 17a, 17b, 18a, and 18b) .. .. .	30	3 $\frac{1}{2}$	61·0	1991	4063
500 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure; mean of 2 experiments (Plots 5a and 5b) .. .. .	30	1 $\frac{1}{2}$	60·4	1996	4442
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Mineral Manure, and 500 lbs. Rape-cake; mean of 2 experiments (Plots 7a and 7b) .. .. .	32	0 $\frac{1}{2}$	61·1	2123	4383

Under the influence of the cold and unsettled summer of 1850, the produce of corn in the experimental field was several bushels less than under parallel conditions of manuring in 1849, but that of straw was considerably more; and the weight per bushel of dressed corn, though much lower than in 1849 and several other years, was above the average of the 20 years.

The proportion of increase when ammonia-salts were used alone was even greater than in some of the earlier years; in fact, only 2 bushels per acre less than where the same amount of ammonia-salts was used in conjunction with mineral manure; the quantity of straw was, however, proportionally much greater where the mineral manure was also employed. Again, unlike

the result of 1849, 500 lbs. of ammonia-salts (with mineral manure) gave scarcely as much grain as 400 lbs., but considerably more straw than the latter.

Upon the whole, the experimental crop was probably not so far inferior to the average as the wheat-crop of the country was generally estimated to be; but under the influence of the cold and unsettled summer the tendency of high manuring was to give a deficient amount of grain, and an excessive proportion of straw.

### *Eighth Season, 1850-1.*

October (1850) was very fine, but very cold; November, December, and January (1851) were, upon the whole, fine and mild. February was generally fine, but cold. March was, for the most part, wet, cold, and windy. In April there was a good deal of rain, and the temperatures were low during the first half of the month. May and the greater part of June were dry, but unseasonably cold; July was also colder than usual, and during the month a good deal of rain fell heavily at intervals. August was very fine until nearly the end of the month, when heavy rain fell. September was fine throughout, but with rather low temperatures. In June, July, August, and September, the dew-point ranged low, but in August less, and in September more so, than in the other months; the degree of humidity of the air also was, in each of these months, below the average—less so in June and July than in August, and considerably less in August than in September.

Upon the whole, therefore, the winter was mild, the spring and a great part of the summer were cold and unsettled, but the ripening and harvest periods, though cold, were, upon the whole, fine and dry. The wheat-crop of the country was considered to be decidedly above that of 1850, both in quantity and quality, but inferior to that of 1849, especially in quantity.

In the experimental field the allotment of manures was much the same as in several preceding seasons; the chief alteration being that in a few cases the amounts of ammonia-salts and of rape-cake were increased. In one instance in this season (Plot 16*a*), as also in the two succeeding seasons, common salt was employed, for the results of which the reader is referred to the Appendix Tables VIII., IX., X., and XI., pp. 160-5.

Under the influence of the prevailing cold and ungenial growing period of 1851, the amounts of gross produce, corn and straw together, were, under like conditions of manuring, not very different from those of 1850 and 1849; but the proportion of corn to straw was somewhat higher than in 1850, though in a greater degree lower than in 1849. Indeed, the results in the experi-

TABLE VIII.—SUMMARY of the Results of the EIGHTH SEASON, 1850–51.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	15	3½	61·1	1083	1627
14 tons Farmyard Manure (Plot 2) .. .. .	29	2½	63·6	2049	3094
Mineral Manure alone; mean of 2 experiments (Plots 0 and 1) .. .. .	18	2½	61·8	1274	1854
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Plot 10 <i>a</i> .. .. .	28	3½	61·9	1966	3070
200 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure (Plot 8 <i>b</i> ) .. .. .	27	2¼	62·6	1863	2830
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure: mean of 12 experiments (Plots 6 <i>a</i> , 6 <i>b</i> , 11 <i>a</i> , 11 <i>b</i> , 12 <i>a</i> , 12 <i>b</i> , 13 <i>a</i> , 13 <i>b</i> , 14 <i>a</i> , 14 <i>b</i> , 17 <i>a</i> , and 17 <i>b</i> ) .. .. .	31	2¾	62·8	2155	3511
600 lbs. Ammonia-salts (equal parts Sulphate and Muriate), and Mineral Manure; mean of 4 experiments (Plots 5 <i>a</i> , 5 <i>b</i> , 16 <i>a</i> , and 16 <i>b</i> ) .. .. .	36	3½	63·4	2521	4248
400 lbs. Ammonia-salts (equal parts Sulphate and Muriate), Mineral Manure, and 1000 lbs. Rape- cake; mean of 2 experiments (Plots 7 <i>a</i> and 7 <i>b</i> ) .. .. .	37	0½	63·0	2528	4444

mental field agreed with the estimates of the wheat-crop over the country generally, in showing the order of the highest grain-yielding quality of the three seasons to have been 1849, 1851, 1850, and that of the highest straw-producing character to have been, on the other hand, 1851, 1850, and 1849. The amount of produce, both corn and straw, was, however, below the average of the 20 years of experiment; though the proportion of corn to straw was fully equal, and the weight per bushel of the grain considerably above the average, these favourable characters being doubtless due to the prevailing dry weather during the maturing and harvest periods.

The season was, upon the whole, pretty favourable for the action of nitrogenous manures, the difference between the produce by ammonia-salts when used alone, and in conjunction with mineral manures, being less than frequently; whilst 600 lbs. of ammonia-salts (with mineral manure), though an excessive amount for the average of seasons, gave not very far short of the same amount of increase of corn for a given quantity of ammonia employed as when only 400 lbs. were used. Both these amounts, however, gave proportionally much less increase than only 200 lbs.



As already explained, and indicated by the few comments made on the results, the arrangement of the manures of the first eight seasons was determined on each year with reference to certain individual points, regard being at the same time paid to the previous manuring and produce of the respective plots, and much more uniformity observed from year to year in the later years. From this time forward, it was sought to bring the whole of the plots still more strictly into comparison one with another, each year, and through a series of years, in order to trace, by the conjoint aid of the field-results and analysis, the relative excess, or deficiency, of the available supply of the different constituents required by the crop, year by year, and through a long course of years. To this end, in the ninth and eleven succeeding years, the manure has been, with a few special exceptions, the same from year to year on the same plot. The only exceptions requiring notice here are, that the manures of Plots 17 and 18 are annually transposed, and that in the sixteenth and succeeding seasons some of the mineral manures were reduced in quantity per acre on all the plots where they had been previously applied.

Appendix Table IX., p. 162, shows, in a tabular form, the manure applied to each plot, in each of the last 12 years of the experiments; but it will be well to give a more explanatory statement of the description and arrangement of the manures in this place. In doing so the plots will not be enumerated in the same order as in the field, and in the Appendix Tables, but in such as will best indicate the points of comparison which it was sought to establish by the arrangement adopted.

The plan, description, and quantities per acre per annum, for the 12 years (1852-63), were as follows:—

Plot 2.—14 tons farmyard manure (also for the eight preceding years).

Plot 3.—Unmanured (also for the eight preceding years).

Plot 20.—Unmanured (also for five preceding years), duplicate at the other side of the field.

Plot 4.—Unmanured (sulphate of ammonia, and bone-ash acted upon by hydrochloric acid, for seven preceding years).

Plot 0.—Superphosphate of lime alone; composed of 600 lbs. bone-ash and 450 lbs. sulphuric acid, sp: gr: 1·7 (also for three preceding years).

Plot 1.—Mixed alkalis; composed of 600 lbs. sulphate of potass, 400 lbs. sulphate of soda, and 200 lbs. sulphate of magnesia (also for three preceding seasons); reduced to 400, 200, and 200 lbs. respectively, in the sixteenth and succeeding seasons.

Plots 5 (*a* and *b*).—Mixed mineral manure; composed of—

300 lbs. sulphate of potass.

200 lbs. sulphate of soda.

100 lbs. sulphate of magnesia.

200 lbs. bone-ash . . . . . }  
150 lbs. sulphuric acid, sp: gr. 1·7 } superphosphate of lime.

In the sixteenth and succeeding seasons the sulphate of potass was reduced to 200 lbs., and the sulphate of soda to 100 lbs.

Plot 21.—Mixed mineral manure, as Plots 5, and 100 lbs. muriate of ammonia.

Plot 22.—Mixed mineral manure, as Plots 5, and 100 lbs. sulphate of ammonia.

Plots 6 (*a* and *b*).—Mixed mineral manure, as Plots 5, and 100 lbs. each, sulphate and muriate of ammonia.

Plots 7 (*a* and *b*).—Mixed mineral manure, as Plots 5, and 200 lbs. each, sulphate and muriate of ammonia.

Plots 8 (*a* and *b*).—Mixed mineral manure, as Plots 5, and 300 lbs. each, sulphate and muriate of ammonia.

Plots 16 (*a* and *b*).—Mixed mineral manure, as Plots 5, and 400 lbs. each, sulphate and muriate of ammonia.

Plots 17 (*a* and *b*).—200 lbs. each, sulphate and muriate of ammonia in the ninth and every alternate season; and mixed mineral manure, as Plots 5, in every intermediate season.

Plots 18 (*a* and *b*).—Mixed mineral manure, as Plots 5, in the ninth and every alternate season; and 200 lbs. each, sulphate and muriate of ammonia in every intermediate season.

Plot 10 *a*.—200 lbs. each, sulphate and muriate of ammonia (ammonia-salt alone also in the seven preceding seasons, succeeding silicate of potass and superphosphate of lime in the first season).

Plot 10 *b*.—200 lbs. each, sulphate and muriate of ammonia (the same in the eighth season, mixed mineral manure in the seventh, ammonia-salts in the sixth, ammonia-salts and mixed mineral manure in the fifth, ammonia-salts in the fourth, unmanured in the third, ammonia-salts in the second, and silicate of potass and superphosphate of lime in the first season).

Plots 11 (*a* and *b*).—200 lbs. each, sulphate and muriate of ammonia, and superphosphate of lime as Plots 5.

Plots 12 (*a* and *b*).—200 lbs. each, sulphate and muriate of ammonia, superphosphate of lime as Plots 5, and 550 lbs. sulphate of soda (reduced to 366 lbs. in the sixteenth and subsequent seasons).

Plots 13 (*a* and *b*).—200 lbs. each, sulphate and muriate of ammonia, superphosphate of lime as Plots 5, and 300 lbs. sulphate of potass (reduced to 200 lbs. in the sixteenth and subsequent seasons).

Plots 14 (*a* and *b*).—200 lbs. each, sulphate and muriate of ammonia, superphosphate of lime as Plots 5, and 420 lbs. sulphate of magnesia (reduced to 280 lbs. in the sixteenth and subsequent seasons).

Plot 9 *a*.—550 lbs. nitrate of soda, and mixed mineral manure as Plots 5 (only 475 lbs. nitrate in the ninth, and 275 lbs. in the tenth and eleventh seasons, and no mineral manure in the ninth, tenth, and eleventh seasons, commencing only in the twelfth).

Plot 9 *b*.—550 lbs. nitrate of soda alone (only 475 lbs. in the ninth season).

Plot 15 *a*.—Mixed mineral manure, as Plots 5 (but with 200 lbs. hydrochloric instead of 150 lbs. sulphuric acid), and 400 lbs. sulphate of ammonia.

Plot 15 *b*.—Mixed mineral manure, as Plots 5 (but with 200 lbs.

hydrochloric instead of 150 lbs. sulphuric acid), 300 lbs. sulphate of ammonia, and 500 lbs. rape-cake.

Plot 19.—200 lbs. bone-ash, 200 lbs. hydrochloric acid, 300 lbs. sulphate of ammonia, and 500 lbs. rape-cake.

The sulphates of potass, soda, and ammonia, the muriate of ammonia, and the nitrate of soda, were the ordinary articles of commerce passing under those names; the sulphate of magnesia was Epsom salts. In the following Tables, and discussion, the term “ammonia-salts” will, for brevity, be employed to designate the equal mixture of the sulphate and muriate of ammonia.

The only exception to the above statement of manuring for each of the last 12 years is, that in the first two of them, namely, 1852 and 1853 (and also in the immediately preceding year, 1851), chloride of sodium, or common salt, at the rate of 3 cwts. per acre per annum, was applied to Plot 16 *a*, in addition to the manures enumerated above for that plot.

In the few comments which now follow on the produce of each separate season, with the view of showing the varying effects of one and the same manure according to season, but little reference will be made either to the varying condition of the different plots due to the varying character of the manuring during the preceding eight years, or to that attributable to use of the same manure year after year on the same land; leaving the important question of the limit, or degree, of the effect of accumulation or exhaustion from previous manuring and cropping on the produce of succeeding seasons, for entirely separate consideration further on.

#### *Ninth Season, 1851-52.*

October (1851) was, for the most part, fine and mild; November fine, but very cold; December less severe; January and February (1852) mild, with a good deal of rain; March dry and clear, but cold and frosty; April dry, with some hot sun, but a good deal of cold east wind; May variable, but with a good deal of cold east wind; June very wet and cold; July very hot, with several heavy thunderstorms; August, fine at the beginning, very wet in the middle, and fine and hot at the end; September, fine until the 6th, when there was a heavy thunderstorm, with a good deal of rain, the rest of the month being variable, with prevailing low temperatures, but upon the whole not unfavourable. In June the dew-point was below, but the degree of humidity of the air slightly above the average; in July the dew-point was above, but the degree of humidity considerably below the average; and in August and September both dew-point and degree of humidity were notably below the average.

The winter was, therefore, upon the whole, favourable; the

spring dry, cold, and backward; the early summer rainy and cold, and the maturing period variable, with a good deal of hot weather, and some heavy storms.

The wheat-crop was reported to be generally not deficient in bulk, but in many districts much blighted, mildewed, and grown, the result being a yield considerably below the average.

In the following Table is given such a selection of the experimental results as will best illustrate the influence of the season on the productive effects of the different descriptions of manure employed; and all future summaries given to illustrate the characters of the seasons will relate to the produce of the same plots.

TABLE IX.—SUMMARY of the Results of the NINTH SEASON, 1851-2.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	13	3 $\frac{1}{4}$	56·6	860	1597
14 tons Farmyard Manure (Plot 2) .. .. .	27	2 $\frac{1}{4}$	58·2	1716	3457
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	21	3 $\frac{1}{2}$	55·9	1320	2787
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	16	3 $\frac{1}{2}$	57·4	1052	1968
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	19	2	56·4	1177	2144
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	20	3 $\frac{1}{4}$	57·5	1294	2593
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	26	3	55·9	1629	3811
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	27	2	55·9	1675	3789
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	28	1 $\frac{3}{4}$	54·7	1747	4646

The unmanured produce of grain was the lowest yet obtained, and below the average of the 20 years. The effect of a given amount of ammonia-salts, whether alone or in conjunction with mineral manure, was very much below the average, especially so far as the production of grain was concerned, and where large quantities were used. Even the produce of straw was considerably below the average obtained under like conditions of manuring; but much more so where the small than where the large amounts of ammonia-salts were employed. The weight per bushel of dressed corn was also throughout very low, but especially so in the case of the heavier crops.

Upon the whole, the produce of the experimental field was the worst yet obtained.



## Tenth Season, 1852-3.

October and November (1852) were very wet, and, the latter month particularly, very unseasonably warm; December and the first half of January (1853) were also unseasonably mild with a good deal of rain; the rest of January, February, and March, were very cold with a good deal of east and north-east wind, and some snow; April and May were for the most part cold and wet, with the exception of a short period in the middle of each month; June variable, with a good deal of rain and cold wind; the greater part of July was excessively wet with low temperatures, but the end of the month and the beginning of August were fine; the remainder of August and September were dull, unsettled, wet, and cold. Both the dew-point and degree of humidity of the air were generally, and especially the latter, sometimes considerably below the average in June, July, August, and September.

In consequence of the very unfavourable seed-time the breadth of land under wheat was much reduced, and the crop of 1853 was reported to be far inferior to that of any season for many years past.

In the experimental field it was found impossible to work the land, and sow the manures and seed, until February and March, 1853. The following is an abstract of the results obtained from this spring-sown crop:—

TABLE X.—SUMMARY of the Results of the TENTH SEASON, 1852-3.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &C.			
	Dressed Corn.		Total Corn.	Straw and Chaff.
	Quantity.	Weight per Bushel.		
	Bush. Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	5 3 $\frac{1}{4}$	45·9	359	1413
14 tons Farmyard Manure (Plot 2) .. .. .	19 0 $\frac{1}{2}$	51·1	1120	3372
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	9 3 $\frac{3}{4}$	48·6	642	2049
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	10 0 $\frac{3}{4}$	48·6	599	2040
Mixed Mineral Manure, and 100 lbs. Ammonia-salts (mean of Plots 21 and 22) .. .. .	11 2 $\frac{1}{2}$	49·8	673	2021
Mixed Mineral Manure, and 200 lbs. Ammonia-salts (mean of Plots 6a and 6b) .. .. .	18 0 $\frac{1}{4}$	51·5	1030	2788
Mixed Mineral Manure, and 400 lbs. Ammonia-salts (mean of Plots 7a and 7b) .. .. .	23 2 $\frac{3}{4}$	52·0	1363	3738
Mixed Mineral Manure, and 600 lbs. Ammonia-salts (mean of Plots 8a and 8b) .. .. .	23 1 $\frac{3}{4}$	51·8	1386	3947
Mixed Mineral Manure, and 800 lbs. Ammonia-salts (mean of Plots 16a and 16b) .. .. .	25 0 $\frac{1}{2}$	52·3	1517	4962

Bad as was the result obtained in the experimental field in 1852, it was very much worse in 1853; indeed, it was, in the latter year, the worst in almost every particular throughout the whole 20 years of the experiments.

Without manure, with farmyard manure, and with the different artificial manures, the produce of grain was considerably less, and the quality worse, than in any other year. The season was very unfavourable for the action of ammonia-salts, especially so far as the production of grain was concerned; though, as in 1852, there was a considerable growth of straw under the influence of the heavier ammoniacal dressings. The weight per bushel of dressed corn was extraordinarily low; being in several instances below, and in none much above 50 lbs.

#### *Eleventh Season, 1853-4.*

The latter end of October, and November (1853), were generally favourable; December, and January and February (1854), were upon the whole unusually severe, with a good deal of snow, excepting that the middle and latter part of January, and the end of February, were comparatively mild and fine; March and the greater part of April were very fine, but at the end of the latter month there was unusually severe frost for the period, and a good deal of cold north wind; May was variable, generally cold, and backward, with a good deal of rain; June was generally fine, but cold; the first half of July was also cold with a moderate amount of rain, then came a week or two of fine hot weather, which was succeeded by thunder-storms and heavy rain; the beginning of August was wet, the middle fine though not warm, but the end dry and hot; September was almost throughout fine and favourable for getting in the crops, with high day, though low night temperatures. In June, July, August, and September, the dew-point was below the average; and the degree of humidity of the air was, in June above, in July about, and in August and September below the average.

Upon the whole, then, the period of seed time had been favourable; the winter was unusually severe; the early spring favourable, but succeeded by cold and unseasonable weather until the middle of July, from which time, however, until harvest, the period, though changeable, embraced some fine maturing and harvest weather.

With these characteristics, by no means continuously favourable, the harvest of 1854, though late, was, particularly so far as wheat was concerned, one of the largest yield per acre for many years past.

As the following summary will show, the produce of the experimental field quite bore out this character.

TABLE XI.—SUMMARY of the Results of the ELEVENTH SEASON, 1853-4.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	21	0 $\frac{1}{4}$	60·6	1359	2137
14 tons Farmyard Manure (Plot 2) .. .. .	41	0 $\frac{1}{2}$	62·5	2675	4450
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	34	1 $\frac{1}{2}$	60·5	2211	3597
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	24	0 $\frac{3}{4}$	61·3	1555	2512
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	31	3 $\frac{1}{4}$	61·1	2012	3390
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	34	0 $\frac{1}{2}$	61·8	2213	3950
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	45	2	61·8	29 7	5550
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	48	2 $\frac{1}{2}$	61·6	3137	6126
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	49	3 $\frac{1}{2}$	61·7	3262	6669

Thus, the experimental wheat-crop of 1854, the eleventh in succession on the same land, was by far the best hitherto obtained, and nearly the best throughout the 20 years. The weight of grain per acre was generally more than double that of the bad season of 1853 under parallel conditions of manuring: it was about equal to that of 1857; and not far short of that of the extraordinary season just past, 1863. In weight of straw, indeed, the crop of 1854 far exceeded that of 1857, and nearly approached that of 1863. The weight per bushel of dressed corn was also considerably above the average, above that of 1857, and little short of that of 1863. The crop was, then, upon the whole, far above the average in quantity both of corn and straw, and in quality of the former.

The produce of corn per acre by ammonia-salts alone, although it was the tenth year of their application on the same plot without mineral manure, was greater than in any preceding year; and, as will be seen further on, the increase obtained for a given amount of ammonia supplied, was, throughout the plots, considerably more than in the average of seasons. And, notwithstanding the season was so favourable for the action of nitrogenous manures, it was even better than the rival years of 1857 and 1863 for the development of the unmanured, and only mineral-manured crops.

Upon the whole, then, consistently with the character of the crop over the country generally, the experimental wheat-crop of 1854 was as remarkable for superiority in almost every particular, both of quantity and quality, as that of 1853 had been in the opposite direction.

*Twelfth Season, 1854-5.*

The autumn of 1854 was, upon the whole, fine and seasonable; December, and the first half of January (1855), were fine and generally mild. Then came severe frost and deep snow, and the frost, with occasional snow, rain, and thaw, lasted with more or less severity, through February and March. The beginning and end of April were also cold and frosty, and the month was more or less windy throughout, with dry east winds at the close. May and June were for the most part very cold and dry, with the exception of a short interval in the middle of that period, and the end of June, which was very hot; July was very variable with many fine hot days, but with severe thunder-storms, and, upon the whole, a great excess of rain. The beginning of August was also wet, but the remainder of the month was fine; September also was fine, but cool. In June, August, and September, both the dew-point and the degree of humidity of the atmosphere ranged low, but in July both were somewhat in excess of the average.

Thus, the latter part of the winter, and the early spring, were extremely severe; the remainder of the spring and the early summer cold and dry; July was very variable, with a great deal of rain, and a rather humid atmosphere; but the maturing and harvest periods were more favourable. With these characters of season, the wheat-crop of 1855 was reported to be much less abundant than that of 1854, and the quality very various.

The experimental crops without manure, by farmyard manure, by mineral manure alone, and by mineral manure in conjunction with the smaller amounts of ammonia-salts, were fully equal to the average of the 12 years in amount both of grain and straw; but those grown under the influence of the heavier ammoniacal dressings were below it in both respects. The proportion of corn to straw, and the weight per bushel of dressed corn, were both rather over than under the average of the 12 years. So far as the experimental plots were concerned, therefore, the season of 1855 was of average productiveness with moderate manuring, but it was unfavourable for high manuring, and for the growth and maturation of large crops.



The following Table shows the character of the results obtained in the experimental field:—

TABLE XII.—SUMMARY of the Results of the TWELFTH SEASON, 1854-5.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	17	0	59·2	1072	1787
14 tons Farmyard Manure (Plot 2) .. .. .	34	2½	62·0	2237	3845
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	19	3¾	57·1	1285	2512
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	18	1½	60·0	1150	1820
Mixed Mineral Manure, and 100 lbs. Ammonia-salts (mean of Plots 21 and 22) .. .. .	24	2¼	60·5	1543	2438
Mixed Mineral Manure, and 200 lbs. Ammonia-salts (mean of Plots 6a and 6b) .. .. .	28	0	60·6	1782	2937
Mixed Mineral Manure, and 400 lbs. Ammonia-salts (mean of Plots 7a and 7b) .. .. .	33	0	59·5	2111	4035
Mixed Mineral Manure, and 600 lbs. Ammonia-salts (mean of Plots 8a and 8b) .. .. .	31	2	58·8	2031	4090
Mixed Mineral Manure, and 800 lbs. Ammonia-salts (mean of Plots 16a and 16b) .. .. .	32	3¾	58·2	2108	4763

### Thirteenth Season, 1855-6.

In October (1855) a great deal of rain fell; November was generally fine, but cold. The greater part of December was extremely cold, with severe frosts, some snow, and piercing east winds, but the end of the month was warm. January (1856) was very variable, but, upon the whole, mild, as was also February; March dry and cold, with piercing north-east winds; April and May generally cold, and May particularly very wet; June and July changeable as to temperature, with little rain, and frequently very cold nights until nearly the end of the latter month, which, with the beginning of August, was fine and hot; then came heavy thunder-storms with excessive rain, but the end of August, and the first half of September, were fine, after which again succeeded thunder-storms and heavy rain; and the temperature was generally low throughout the month. The mean dew-point and degree of humidity were above or about the average in June, July, and August, and somewhat below it in September.

Thus, the winter was upon the whole mild; the early spring dry and cold, and the remainder cold and wet; the early summer cold and changeable, then came a short interval of fine and hot weather, succeeded, about the ripening period, by very heavy

rains, and prevailing low temperatures. The harvest period was also generally wet and unfavourable, especially in the later districts.

The extent of land under wheat was reported to be considerably above the average, and shortly before harvest the opinion prevailed that the crop would be of more than average productiveness; but owing to the unfavourable harvest weather a considerable proportion of it was badly got in.

The following results were obtained in the experimental field:—

TABLE XIII.—SUMMARY of the Results of the THIRTEENTH SEASON, 1855-6.

MANURES, (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	14	2	54·3	892	1558
14 tons Farmyard Manure (Plot 2) .. .. .	36	1½	58·6	2277	4317
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	24	0¾	55·6	1505	2818
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	19	2¼	56·3	1207	2067
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	22	1¾	57·9	1375	2514
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	27	3	58·3	1736	3072
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	36	3¾	57·8	2278	4479
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	39	0	57·0	2454	5136
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	37	3¾	58·6	2438	5498

The quantity of corn per acre, excepting on the unmanured plot, was fully equal to, and that of the straw rather over, the average of the last 12 of the 20 years. But the crop was unevenly and badly ripened, and the weight per bushel was low. The season was, indeed, not unfavourable to quantity of produce; and, so far, to a fair average productiveness under the influence of liberal manuring; but it was unfavourable for the full development and the maturation of the grain.

#### *Fourteenth Season, 1856-7.*

The latter part of October and a great portion of November (1856) were fine and seasonable, but the end of November and beginning of December were unusually severe: then came a short period of very mild weather, with a good deal of rain, followed with fine frosty weather; the quarter having been marked by rapid variations of pressure, and extreme changes of temperature.

In January (1857) there was a good deal of rain, and the greater part of the month was mild; but it became colder, with frost and snow at the end of the month and the beginning of February. The remainder of February, and March, were very dry, with high barometer, frequent sharp frosty nights, and cold easterly winds. In April there was more rain, but also a good deal of fine though cold weather. May was fine, with a good deal of very warm weather, and but little rain. In June there was a good deal of fine and hot weather, but there were also several thunder-storms, with heavy falls of rain, which were much needed, and thoroughly penetrated the soil. During July the weather was generally fine, and occasionally very hot, with much less than the usual amount of rain. In August there were several thunder-storms with heavy rain, but otherwise the weather was fine and remarkably hot. In the early part of September a good deal of rain fell, but the remainder of the month was fine, and its temperature was pretty uniformly rather above the average. In June, July, and August, though the dew-point ranged somewhat high, the temperature did so in a greater degree, so that the atmosphere was drier than usual.

The winter, excepting in the early part, was therefore generally mild; the spring was less so, with a good deal of dry weather, but with a sufficiency of rain in April. The summer was for the most part hot, with a dry atmosphere, but with genial and plentiful rains in June and the beginning of August; and the harvest period was generally favourable.

TABLE XIV.—SUMMARY of the Results of the FOURTEENTH SEASON, 1856-7.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	19	3 $\frac{3}{4}$	58·3	1236	1577
14 tons Farmyard Manure (Plot 2) .. .. .	41	0 $\frac{3}{4}$	60·4	2587	3323
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	29	0 $\frac{1}{2}$	58·0	1816	2392
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	23	3	58·9	1461	1676
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	23	2 $\frac{1}{4}$	60·6	1515	1811
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	35	1 $\frac{1}{2}$	59·9	2202	2757
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	44	3 $\frac{1}{2}$	60·4	2842	3786
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	48	1	60·7	3094	4374
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	49	1 $\frac{1}{2}$	60·5	3163	4693

The extent of land under wheat was reported to be less than in 1856; but throughout the summer the crop promised extremely well, and after harvest it was estimated to have been unusually productive.

The character of the experimental wheat-crop of 1857 was in many points remarkable, and accorded well with the estimates formed of the crop over the country generally. The amount of gross produce (corn and straw together) fell considerably short of that of either 1854 or 1863, and did not exceed that of several other years of much inferior yield of grain; but the proportion of corn to straw was unusually high, being only surpassed among the experimental seasons in 1854, and about equalled in 1846 and 1849, though in neither of these two years was the amount of produce per acre at all equal to that of 1857. The quantity of straw was, in fact, even below the average, considerably less than the amount of 1854, and still more below that of 1863. But the produce of grain, especially under the influence of high nitrogenous and mineral manuring, was almost identical with that of 1854, the two seasons standing in this respect second only to 1863; whilst, both without manure, and with mixed mineral manure alone, the yield of 1857 even exceeded that of the extraordinary season just passed (1863).

It was, however, especially where the large amounts of ammonia-salts, in conjunction with the mineral manure, were employed, that the tendency to the production of grain rather than of straw was in 1857 so marked, and so much above the average. It is further worthy of remark, that both in 1854, which was the eleventh season, and in 1857, which was the fourteenth season of wheat on the same land, the unmanured produce amounted to about 20 bushels, that by farmyard manure to about 41 bushels, and that by the heaviest artificial manuring to within a fraction of 50 bushels per acre.

#### *Fifteenth Season, 1857-8.*

October, November, and December (1857) were, upon the whole, very mild, with unusually little rain during the two latter months. January (1858) was also very dry, and during the last fortnight cold, with north wind and sharp frost. February was also generally cold, with a fair amount of rain, and some snow in the earlier part, and sharp frosts and easterly winds in the latter part of the month. In March there was little rain, but frost, snow, and strong easterly winds in the earlier part of the month. The beginning of April was cold, but most of the remainder fine, and even hot, and a moderate amount of rain fell in the beginning and end of the month; it was also cold in the beginning of May, but fine, dry, and hot towards the end, though with



heavy showers, and about an average fall of rain during the month. June was upon the whole very fine, dry, and hot, with some heavy thunder-showers, but much less than the average amount of rain. In July there was much more rain, and the weather, though variable, was still upon the whole fine and hot. August and September were very fine, with much less than the average fall of rain. Throughout the quarter ending with September, as also in June, the degree of humidity of the atmosphere ranged notably lower than usual.

There was, therefore, during the winter, spring, and summer of 1857-8, upon the whole, much less than the usual amount of rain; though in February, April, May, and July, there were fair amounts. The air was also generally less humid than usual throughout the summer. The temperature, too, was generally above the average throughout the spring and summer months, whilst June was unusually hot.

Early in the summer the appearance of the wheat-plant was generally that of great luxuriance, promising a bulky crop. Owing to the prevailing dry and warm weather of June the harvest was very early, and the months of August and September were favourable both as to dryness and temperature. The reports indicated a crop fully if not above the average, though by no means equal to the extraordinary one of the immediately preceding season.

The following Table shows the character of the results in the experimental field:—

TABLE XV.—SUMMARY of the Results of the FIFTEENTH SEASON, 1857-8.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	18	0	60·4	1141	1670
14 tons Farmyard Manure (Plot 2) .. .. .	38	3 $\frac{1}{4}$	62·6	2512	3837
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	22	3 $\frac{1}{2}$	59·6	1439	2130
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	18	3 $\frac{3}{4}$	61·4	1207	1588
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	23	1	61·5	1493	2277
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	28	3 $\frac{1}{2}$	61·1	1834	2645
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	39	0 $\frac{1}{4}$	62·1	2490	4029
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	41	3 $\frac{1}{2}$	61·8	2678	4667
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	41	3 $\frac{3}{4}$	62·1	2710	4805

With the moderate dressings the quantity of gross produce per acre (corn and straw together) was rather below the average of the 12 years; but with the higher manuring it was generally equal, and sometimes above it. The quantity of straw was pretty uniformly below the average under parallel conditions of manuring; but the produce of grain was generally above it, and the more so the higher the manuring. The proportion of corn to straw was, therefore, above the average, and the weight per bushel of dressed corn was also rather high.

Thus, so far as the results in the experimental field are concerned, the season of 1858 was, upon the whole, favourable to high proportion and good quality of grain, under the influence of somewhat liberal manuring. There was, however, a very marked decline in the productiveness of a given amount of ammonia where the excessive amounts of it were employed, indicating a somewhat easily reached limit of the productive capabilities of the season.

#### *Sixteenth Season, 1858-9.*

During October, November, and the first half of December (1858) there was very little rain, and during November and the early part of December the weather was very cold. The remainder of December, and January and February (1859) were very fine and mild; March was also upon the whole mild, but with more rain; in April, too, a good deal of rain fell, and the latter part of the month was stormy, wet, and cold. May began with cold dry easterly winds, then came a good deal of rain, succeeded by fine and hot weather. During June there were several heavy thunderstorms, a great deal of rain fell, and the air was more humid than usual, though there was also a deal of fine warm weather. July was upon the whole fine and unusually hot, but there were several severe thunderstorms at the beginning and about the middle of the month. August was rather unsettled, but for the most part warm, with a good deal of rain; September was also unsettled, and cold, with an excessive amount of rain. In July the dew point ranged high, but the temperature relatively higher; and throughout the quarter ending with September the degree of humidity of the air was below the average.

Thus, throughout the winter of 1858-9 there was very little rain, and, with the exception of the early part, the weather was very mild. In April there was a full supply of rain, May a deficiency, June a considerable excess, July a moderate amount, August a full, and September an excessive fall; whilst June and July were considerably above the average temperature—July more especially, bringing the wheat rapidly forward; though,

owing to the heavy rains of June, and the bulk of the crop, it was generally much laid. Still, the prospect before harvest was upon the whole good; but the wet and stormy harvest period, and the length of time the crop was out, led to a good deal of injury, especially to the heavier crops, and when got in the yield was estimated to be below the average.

The following results were obtained in the experimental field:—

TABLE XVI.—SUMMARY of the Results of the SIXTEENTH SEASON, 1858-9.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush. Pks.	lbs.	lbs.	lbs.	
Unmanured (Plot 3) .. .. .	18 1 $\frac{1}{4}$	52·5	1051	2175	
14 tons Farmyard Manure (Plot 2) .. .. .	36 0 $\frac{3}{4}$	56·5	2263	4810	
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	18 3 $\frac{3}{4}$	51·5	1207	2730	
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	20 2 $\frac{1}{2}$	56·0	1275	2358	
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	25 1	54·5	1499	3083	
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	29 3 $\frac{1}{2}$	56·5	1832	3800	
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	34 2 $\frac{1}{2}$	55·9	2093	4740	
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	34 2	53·7	2038	5475	
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	34 2 $\frac{3}{4}$	52·6	2016	5860	

The experimental crops were more than usually bulky wherever the manuring was liberal. With the smaller amounts of ammonia-salts (and mineral manure), the quantity of grain per acre was also slightly above the average; but with the heavy dressings of ammonia there was a considerable deficiency of corn, and a very undue proportion of straw. The weight per bushel of dressed corn was extremely low, though considerably lower with deficient mineral, or excessive nitrogenous manuring. There was less corn by ammonia-salts alone than by mixed mineral manure alone; and even when the ammonia-salts were used in conjunction with mineral manure, there was less corn, though a good deal more straw, from the use of the excessive amounts of 600 lbs. and 800 lbs., than when only 400 lbs. were employed.

It may be observed that this was the first of the years in which there was a reduction of potass and soda in all, and of magnesia in some of the cases, where these bases were formerly supplied.

In this and succeeding seasons the sulphate of potass was in all cases reduced to two-thirds the previous amount; the sulphate of soda to one-half in all cases of the so-called "mixed mineral manure," but only to two-thirds on Plots 12*a* and 12*b*. The sulphate of magnesia was, however, not reduced in the "mixed mineral manure," and only by one-third on plots 14*a* and 14*b*. Still, wherever potass, soda or magnesia were supplied at all, even the reduced amounts provided more of them annually than was taken off in the crops.

Upon the whole, the season of 1859, with its wet and warm growing and ripening, and wet harvest periods, was one of considerable amount of produce, but of very inferior characters for the formation and maturation of the grain.

### *Seventeenth Season, 1859-60.*

October (1859) was upon the whole wet, the greater part of the month very mild, but the end very cold and frosty; November stormy, cold, and wet; December very cold, windy, and inclement until near the end, which was wet and mild. January (1860) was variable, but generally mild and wet; February very cold, with sharp frost and snow, ending with storms of rain and wind. The greater part of March was cold, with heavy showers and snow; the remainder was finer and warmer. April was very cold, with some snow and sharp frosts; the beginning of May was also cold, but the rest of the month warmer than usual, though very wet. June was very cold and very wet; July also very cold, with a moderate amount of rain, most of which fell after the middle of the month; August cold and very wet, and September also cold, but fine in the early part, though very wet in the latter. In June, July, August, and September, the dew point generally ranged low; but with the unusually low temperatures, the degree of humidity of the air was considerably above the average.

The winter of 1859-60 was thus alternately very cold and very mild, and upon the whole very wet; and the spring, summer, and autumn were very stormy, cold, wet, and unseasonable; indeed, more so than had been known for many years past. The crops were very late, the harvest being two or three weeks later than usual. Wheat was, in some localities, not deficient in bulk, but generally very much damaged, yielding but a small proportion of grain, and that of very low quality. The crop was, indeed, very much below the average both in quantity and quality.

The quantity of grain in the experimental field was generally only about three-fourths that of the average of the 12 years under



equal conditions of manuring; but the deficiency was proportionally less with the heavier dressings. The quantity of straw was also much below the average, though not quite so much so as that of the grain; but, as in the case of the latter, it was proportionally less deficient with the heavier manuring. The quality of grain, as indicated by the weight per bushel of the dressed corn, was throughout extremely low; in fact, lower than in any other year of the 20, excepting 1853.

The following abstract shows the character of the experimental crops:—

TABLE XVII.—SUMMARY of the Results of the SEVENTEENTH SEASON, 1859-60.

MANURES, (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	12	3 $\frac{1}{2}$	52·6	738	1459
14 tons Farmyard Manure (Plot 2) .. .. .	32	1 $\frac{1}{4}$	55·5	1864	3440
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	15	0 $\frac{1}{2}$	49·5	905	2213
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	15	3 $\frac{3}{4}$	53·6	919	1620
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	14	2 $\frac{3}{4}$	53·2	870	1657
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	22	0	54·0	1268	2288
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of plots 7a and 7b) .. .. .	27	3	54·3	1605	3070
Mixed Mineral Manure, and 600 lbs. Ammonia- salts, (mean of Plots 8a and 8b) .. .. .	31	2	52·6	1773	3847
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	32	2 $\frac{1}{2}$	51·9	1873	4162

The experimental crop of the extraordinarily wet and cold growing and ripening season of 1860 was, therefore, in every respect very inferior, and much below the average. In yield of grain it was only about equal in quantity, and it was inferior in quality, to that of 1852, and inferior to it also in produce of straw. But it was superior both in quantity and quality of grain to the miserable crop of 1853, though even inferior to it in weight of straw.

#### *Eighteenth Season, 1860-61.*

October (1860) was, upon the whole, seasonable; November was very cold, with a good deal of rain; the beginning of December was mild, but the remainder of the month, and a great

part of January (1861) were extremely severe, many evergreens of long standing being killed during this period. The remainder of January, and February, were much milder, with comparatively little rain. There was, nevertheless, a good deal of cold wind during the latter month, as also pretty continuously through March, April, and the beginning of May, during which periods the rain-fall was below the average. The remainder of May was dry and fine, and even hot. June commenced with cold wind and rain, followed by an interval of fine and hot weather, and then a good deal of rain to the end of the month. July was generally seasonable as to temperature, with less than an average of rain. At the beginning of August some heavy rains fell, but, upon the whole, the month was very dry, fine, and favourable; and the fine weather continued, but with rather low temperature, and a good deal of wind, through the greater part of September, though towards the end of the month a great deal of rain fell. In June, both the dew point and degree of humidity of the air ranged high; but in July, August, and September, they were not far from the average.

The winter of 1860-61 was thus unusually severe, and the autumn-sown wheat-plant was reported to have suffered considerably. The spring of 1861 was generally dry, with a good deal of cold wind; but plentiful rains, and some hot weather, in June, brought the growing crops rapidly forward. July, August, and the greater part of September were, upon the whole, seasonable as to temperature, and degree of humidity of the atmosphere, with less than the usual amount of rain.

The wheat-crop was reported to be generally below the average in quantity per acre, the result being due chiefly to the loss of plant during the winter. It also suffered a good deal from rust, but benefitted much by the favourable weather of the latter part of the summer and of the autumn; fair average, and, in many cases, good quality, compensating somewhat for deficiency of quantity.

In produce of grain per acre, the unmanured, and the deficiently manured plots, were considerably below the average of the 12 years; but the more highly manured ones, though still below, were much more nearly up to the average, and the weight per bushel of dressed corn was throughout rather over the average. The produce of straw was also considerably below the average.

The experimental crop was, therefore, upon the whole, deficient both in quantity of total produce, and yield of grain per acre, but the quality of the latter was fully equal to the average. The crop was, however, in all respects superior to that of 1860;

and, excepting in amount of straw, it was, under the better conditions of manuring, superior to that of 1859 also.

The following is an abstract of the results obtained in the experimental field :—

TABLE XVIII.—SUMMARY of the Results of the EIGHTEENTH SEASON, 1860-61.

MANURES, (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	11	1 $\frac{1}{4}$	57·4	736	1254
14 tons Farmyard Manure (Plot 2) .. .. .	34	3 $\frac{1}{2}$	60·5	2202	3101
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	12	3 $\frac{1}{2}$	55·0	854	1930
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	15	1 $\frac{3}{4}$	59·1	1065	1552
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	18	0 $\frac{1}{4}$	58·4	1208	1799
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	27	2 $\frac{1}{4}$	59·4	1787	2628
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	34	3 $\frac{3}{4}$	58·9	2223	3528
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	35	0	58·4	2240	3854
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	37	0	58·3	2385	4383

*Nineteenth Season, 1861-62.*

October (1861) was generally mild, fine, and dry; November inclement, with an excess of rain, and unusually low temperatures. December was, upon the whole, warmer and drier than usual, but with a good deal of cold wind towards the end. January and February (1862) were, upon the whole, fine and dry, with a good deal of warmer and but little of colder weather than usual. March commenced with frosty weather, but the greater portion of it was unusually wet and mild. April was variable, with some unseasonably cold, but a good deal of warm weather, and a full average amount of rain. May was extremely wet, and, in the early part especially, unusually warm. June, July, and August were almost throughout unsettled, with a good deal of wind and rain, and unusually low temperatures, the nights especially being frequently very cold; and, although the atmosphere contained less than the average actual amount of moisture, with the low temperatures, the degree of humidity was not correspondingly low. September was also variable, with a good deal of rain

at the beginning and end of the month, but with fine and warm weather intermediately.

The winter of 1861-2 was, therefore, upon the whole, mild; but the spring and summer were almost throughout wet, cold, and stormy. The wheat-crop of the country was almost universally reported to be under the average, in many cases root-fallen, and also much mildewed.

The following results were obtained in the experimental field:—

TABLE XIX.—SUMMARY of the Results of the NINETEENTH SEASON, 1861-62.

MANURES, (Quantities per Acre.)	PRODUCE PER ACRE, &c.				
	Dressed Corn.		Total Corn.	Straw and Chaff.	
	Quantity.	Weight per Bushel.			
	Bush.	Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	16	0	57·8	996	1713
14 tons Farmyard Manure (Plot 2) .. .. .	33	1½	61·0	2447	4195
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	23	0¼	56·5	1457	2593
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	17	3¼	59·0	1110	1850
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	20	1	58·1	1262	2186
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6a and 6b) .. .. .	28	0¾	59·6	1756	2970
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7a and 7b) .. .. .	35	3½	59·4	2333	3910
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8a and 8b) .. .. .	39	1¾	59·2	2465	4679
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16a and 16b) .. .. .	36	1	57·8	2229	4512

The experimental crops, without manure, with farmyard manure, and with the mixed mineral manure in conjunction with all but the most excessive amount of ammonia-salts, were fully equal in amount and quality of grain, and not much deficient in straw, compared with the average of the 12 years. But with mineral manure in conjunction with the very excessive amount of ammonia-salts, the produce of both grain and straw was considerably below the average. Notwithstanding the wetness of the most growing periods of the season, the prevailing low temperatures seem to have been adverse to the production of full amounts of gross produce; but the ripening period seems to have been not so unfavourable to the development of grain where there was moderate luxuriance of growth, and the crop was not too much laid; which, however, according to the reports, was the case



with a considerable proportion of the ordinary wheat-crop of the country.

*Twentieth Season, 1862-3.*

October (1862) was unusually warm, but with a good deal of wind and rain; November was cold, with comparatively little rain; December, and January and February (1863), were unusually mild, with a fair amount of rain in December and January, and but little in February. March was also upon the whole mild, with but little rain; and wheat showed unusually forward growth. April was very dry and warm. In May there were some refreshing rains, but the temperature was occasionally extremely low, and pretty nearly throughout rather below the average, with frequent storms of wind. The temperature in June was also generally rather below the average, and there was a good deal of rain; which, though needed, and much aiding growth, was so heavy as to lay the most forward and bulky crops. In July there was much less rain than usual, with moderately high day, but low night temperatures, and some sharp night frosts. August, with only moderate temperatures, but less than the usual amount of rain, was upon the whole favourable ripening and harvest weather. In September a good deal of rain fell, and the temperatures ranged rather low. In June, the condition of the atmosphere as to moisture was about the average for that month; but, in July, August, and September, both the actual amount and the degree of humidity were below the average.

With these characters of the season, the reports were almost unanimous that the wheat-crop of 1863 was considerably above the average; and such subsequent experience has proved it to be, both in quantity and quality. Indeed, such a yield, per acre, has not been known for very many years.

It would appear that the extraordinary result was due to almost unchecked growth from the first appearance of the plant above ground up to the time of harvest, rather than to any extraordinary characteristics of season at any one or more particular periods. With the extremely mild winter and early spring, the plant came early forward, and the rains, though sparing upon the whole, came when needed, whilst, though the temperature of the summer was seldom high, it was (if we except the night frosts of July) generally sufficient, and the condition of atmosphere otherwise favourable; so that it may be said that the whole season contributed to a lengthened and almost unbroken course of gradual accumulation.

The following Table shows the character of the results obtained in this extraordinary season, in the experimental field:—

TABLE XX.—SUMMARY of the Results of the TWENTIETH SEASON, 1862-63.

MANURES. (Quantities per Acre.)	PRODUCE PER ACRE, &c.			
	Dressed Corn.		Total Corn.	Straw and Chaff.
	Quantity.	Weight per Bushel.		
	Bush. Pks.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	17 1	62·7	1127	1600
14 tons Farmyard Manure (Plot 2) .. .. .	44 0	63·1	2886	4279
400 lbs. Ammonia-salts alone (Plot 10 <i>a</i> ) .. .. .	39 0½	62·6	2587	3481
Mixed Mineral Manure alone (mean of Plots 5 <i>a</i> ) and 5 <i>b</i> ) .. .. .	19 2¾	63·0	1290	1728
Mixed Mineral Manure, and 100 lbs. Ammonia- salts (mean of Plots 21 and 22) .. .. .	28 2¾	62·4	1852	2588
Mixed Mineral Manure, and 200 lbs. Ammonia- salts (mean of Plots 6 <i>a</i> and 6 <i>b</i> ) .. .. .	39 2½	62·3	2528	3715
Mixed Mineral Manure, and 400 lbs. Ammonia- salts (mean of Plots 7 <i>a</i> and 7 <i>b</i> ) .. .. .	53 2¾	62·5	3492	5866
Mixed Mineral Manure, and 600 lbs. Ammonia- salts (mean of Plots 8 <i>a</i> and 8 <i>b</i> ) .. .. .	55 2¾	62·3	3614	6602
Mixed Mineral Manure, and 800 lbs. Ammonia- salts (mean of Plots 16 <i>a</i> and 16 <i>b</i> ) .. .. .	55 3½	62·4	3659	6866

The experimental wheat-crop of 1863, the 20th in succession on the same land, proved to be in quantity of both grain and straw by far the most productive hitherto, and also in quality of grain nearly the best yet obtained. In quantity of straw, or total produce, the crop of 1854 the most nearly approached it; but 1854 and 1857, both of which were years of extraordinary yield, both fell considerably short of 1863 in quantity of grain per acre, and also in quality, as indicated by the weight per bushel.

The season of 1863 was particularly marked by extraordinary productiveness, in both corn and straw, under the influence of a liberal supply of ammonia-salts. Where the quantity applied was not so excessive that the crops were over luxuriant, and much laid by the storms of wind and rain in June, more produce, and especially more corn, was obtained for a given amount of ammonia applied than in any former year of the experiments. Even where the amounts of ammonia-salts were the most excessive, the quantity of both corn and straw per acre was larger than in any preceding season. But, doubtless owing to the heaviest crops having been laid so flat, the amount of increase yielded for each increment of ammonia-salts supplied beyond 400 lbs. per acre

was not so great as in some other seasons. Thus, though in no preceding year had the produce obtained by the mixed mineral manure and the excessive amount of 800 lbs. of ammonia-salts exceeded 50 bushels of dressed corn per acre, that obtained in 1863 by the mixed mineral manure and only 400 lbs. of ammonia-salts was about  $53\frac{3}{4}$  bushels, of  $62\frac{1}{2}$  lbs. weight per bushel; whilst the mixed mineral manure with 600 lbs. of ammonia-salts, gave scarcely  $55\frac{3}{4}$  bushels, and with 800 lbs. scarcely 56 bushels.

Extraordinary as are these amounts of produce, even for good wheat-land cultivated and manured in the ordinary way, they are still more remarkable for the 20th crop of wheat in succession on land of only average wheat-producing quality, which has not been manured with farmyard manure for just a quarter of a century. Nevertheless, there can be no doubt that if the heavier crops had not been so much laid they would have yielded even considerably more. That they did not do so, in a season upon the whole so favourable for the effect of liberal nitrogenous manuring, shows that the higher amounts of ammonia-salts employed were not only excessive for average, but even for unusually favourable seasons.

In conclusion, in regard to these results, it should be observed that whilst the mixed mineral manure and ammonia-salts yielded as much as  $55\frac{3}{4}$  bushels of dressed corn, and 6866 lbs. of straw, the same mixed mineral-manure, when used alone, gave scarcely  $19\frac{3}{4}$  bushels of dressed corn, and only 1728 lbs. of straw. There was an increase, therefore, due to the action of ammonia-salts, of 36 bushels of dressed corn, and 5138 lbs. of straw. In this fact there is surely striking confirmation of the utter inadequacy of mineral-manures alone to enable the wheat-plant to obtain from the atmosphere a sufficiency of nitrogen for the production of full crops.

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No idea is more fixed and prevalent in the farmer's mind than that, after all his labour and money have been expended, he is still at the mercy of the seasons for his reward. The foregoing short abstracts of the results obtained in different seasons, with the few comments made upon them, supply very interesting evidence relating to this point; and Tables XXII.—XXVI., inclusive, in the Appendix, afford the means of studying the subject in much more detail. But the extent of this dependence upon season will be made more strikingly manifest, by placing side by side, at one view, the results obtained by one and the same description and amount of manure in the least favourable, and in the most favourable of the last twelve seasons, during which

the same manure has been applied year after year on the same land. This is done in the following Table:—

TABLE XXI.—SUMMARY of the Results obtained in 1853 and 1863, respectively.

MANURES. (Per Acre, per Annum.)	PRODUCE PER ACRE, &c.					
	Dressed Corn.				Straw and Chaff.	
	Quantity.		Weight per Bushel.			
	1853.	1863.	1853.	1863.	1853.	1863.
	Bush. Pks.	Bush. Pks.	lbs.	lbs.	lbs.	lbs.
Unmanured (Plot 3) .. .. .	5 3 $\frac{1}{2}$	17 1	45·9	62·7	1413	1600
14 tons Farmyard Manure (Plot 2) .. .. .	19 0 $\frac{1}{2}$	44 0	51·1	63·1	3372	4279
400 lbs. Ammonia-salts alone (Plot 10a) .. .. .	9 3 $\frac{3}{4}$	39 0 $\frac{1}{2}$	48·6	62·6	2049	3481
Mixed Mineral Manure alone (mean of Plots 5a and 5b) .. .. .	10 0 $\frac{3}{4}$	19 2 $\frac{3}{4}$	48·6	63·0	2040	1728
Mixed Mineral Manure, and 100 lbs. Ammonia-salts (mean of Plots 21 and 22) .. .. .	11 2 $\frac{1}{2}$	28 2 $\frac{3}{4}$	49·8	62·4	2021	2588
Mixed Mineral Manure, and 200 lbs. Ammonia-salts (mean of Plots 6a and 6b) .. .. .	18 0 $\frac{1}{4}$	39 2 $\frac{1}{4}$	51·5	62·3	2788	3715
Mixed Mineral Manure, and 400 lbs. Ammonia-salts (mean of Plots 7a and 7b) .. .. .	23 2 $\frac{3}{4}$	53 2 $\frac{3}{4}$	52·0	62·5	3738	5866
Mixed Mineral Manure, and 600 lbs. Ammonia-salts (mean of Plots 8a and 8b) .. .. .	23 1 $\frac{1}{2}$	55 2 $\frac{3}{4}$	51·8	62·3	3947	6602
Mixed Mineral Manure, and 800 lbs. Ammonia-salts (mean of Plots 16a and 16b) .. .. .	25 0 $\frac{1}{2}$	55 3 $\frac{1}{2}$	52·3	62·4	4962	6866

It should be observed, that although both the quantity and the quality of corn were, under each of the conditions of manuring specified, lower in 1853 than in any other season of the last twelve, and hence the results of that year are selected to contrast with those of 1863, yet the amounts of straw were much lower in some other years. Indeed, the Table shows that in the case of the mixed mineral manure alone the quantity of straw was even higher in 1853 than in 1863. It was, however, in most cases where ammonia-salts were used, one-half, and sometimes in a greater degree, more in 1863 than in 1853. Again, although the quantity of corn obtained was greater in 1863 than in any other year of the twelve wherever ammonia-salts were used, yet, without manure, and with mixed mineral manure alone, it was higher in several other years.

Notwithstanding these exceptions, which are themselves very interesting and significant, the two seasons may still be taken as upon the whole representing, respectively the least and the most favourable of those to which the experiments refer; and the difference in the quantity and quality of the produce obtained by one and the same manure, in the one season compared with the other, is really most striking and instructive. Thus, in 1863 the produce of dressed corn exceeded that of 1853—without manure by 11 $\frac{1}{2}$  bushels, with farmyard manure by 25 bushels, with 400 lbs.



ammonia-salts alone by  $29\frac{1}{4}$  bushels, with mineral manure alone by  $9\frac{1}{2}$  bushels; and with mineral manure and ammonia-salts together—with 100 lbs. of ammonia-salts by 17 bushels, with 200 lbs. by  $21\frac{1}{2}$  bushels, with 400 lbs. by 30 bushels, with 600 lbs. by  $32\frac{1}{4}$  bushels, and with 800 lbs., by  $30\frac{3}{4}$  bushels. The difference in quantity was, however, in reality much more than these figures indicate; for whilst the weight of each bushel of dressed corn was in 1863 from 62 to 63 lbs., in 1853 it in no case reached, and in some cases fell far short of,  $52\frac{1}{2}$  lbs.

So far as the production of grain was concerned, therefore, the difference of result obtained in the two years was equally striking in point of both quantity and quality.

The important practical question of the amount of ammonia in manure expended for the production of a given amount of increase in one season compared with another, according to the quantity employed, and to the available supply of mineral constituents within the soil, will be made a subject of separate consideration in the Fourth Section of this Report.

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The influence of each individual season, and of the extreme seasons, of the twenty, in tending to the development of much or little corn, much or little straw, and high or low quality of grain, under the different conditions of manuring, has now been briefly illustrated; but before leaving the question of the influence of season altogether, and passing to the more exclusive consideration of the effects of the different manures, it is desirable to endeavour to arrive at some conclusion as to whether the later or the earlier seasons were probably on the average the more favourable; so that a proper judgment may be formed as to whether the actual results obtained by the use of any particular description of manure year after year on the same land, may be referred with but a little reservation to the manure employed, or whether they have been, in any material degree, influenced by a progressive or retrogressive character of the seasons of growth.

There is an obvious inappropriateness in attempting to estimate the progressive or retrogressive productiveness of a series of seasons, by reference to the amounts of produce obtained on the application of a particular manure year after year on the same land, when the object of the estimate is to eliminate the influence of season from that due to the exhaustive or accumulative effect of the manure itself.

The annual produce without manure would appear, at first sight, to be the best index of the relative character of the seasons.

On the other hand, it has been seen that those seasons which were the most favourable for the unmanured, or for the merely mineral-manured plots, were not at all the most favourable for those manured highly with nitrogenous manures—that is, for those conditions under which alone large crops could be obtained. Hence, the best season for land in low condition is not the best for land in high condition.

But, by comparing the increasing or diminishing amount of produce from year to year, under very different conditions of manuring, a very fair judgment of the relative character of the earlier and the later seasons can be formed. To this end there are given at one view in Table XXII. (opposite) the average annual produce without manure, with ammonia-salts alone, and with farmyard manure, respectively over the first half, the second half, and the total period of the experiments; and also the average annual produce without manure, with mixed mineral manure alone, with ammonia-salts alone, with ammonia-salts and mixed mineral manure, and with farmyard manure, over the first six, the last six, and the total of the last twelve years of the experiments.

Taking first the whole period of the experiments (twenty years without manure and with farmyard manure, and nineteen with ammonia-salts alone), there is, without manure a slightly, though very slightly, increased annual produce of corn and total produce (though not of straw) over the last half as compared with the first half of the period; with ammonia-salts alone there is a decreased, and with farmyard manure a very much increased, rate of produce in the later years.

Thus, where the crop was simply dependent on the soil and season, the produce was somewhat higher in the later years; where the resources of the soil were overtaxed by the use of a large amount of ammonia-salts every year, the produce diminished; but where an excess of every constituent was annually applied, the crop enormously increased as the experiment proceeded.

Referring to the results obtained over the last twelve years only, the latter half of that period gives, without manure, as much corn, but scarcely as much straw as the former half; with mixed mineral-manure alone (the condition nearest allied to the unmanured) there is a diminution, more particularly in the produce of straw, in the later years; with ammonia-salts alone there is also a diminution, both of corn and straw, but in a somewhat less degree than when the whole period of twenty years is taken into the calculation. With ammonia-salts and mixed mineral manure together, there is a considerable increase of corn, and,

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

TABLE XXII.—ANNUAL AVERAGE PRODUCE, &amp;c., over the First half, the Second half, and the Total periods of the application of different Manures, each Year after Year on the same Land.

Plot		AVERAGE ANNUAL.			Duration of Total Period.
		First half of Period.	Second half of Period.	Total Period.	
Dressed Corn, per Acre, in Bushels and Pecks.					
3	Unmanured, every year . . . . .	15 3 $\frac{1}{4}$	16 2 $\frac{1}{2}$	16 1	20 years—1844-1863.
10a	Ammonia-salts alone, every year . . . . .	21 3 $\frac{3}{4}$	23 3 $\frac{3}{4}$	24 1 $\frac{1}{2}$	19 years—1845-1863.
2	14 tons Farmyard Manure, every year . . . . .	27 0 $\frac{1}{2}$	37 3 $\frac{1}{4}$	32 1 $\frac{1}{2}$	20 years—1844-1863.
3	Unmanured, every year . . . . .	15 1 $\frac{1}{4}$	15 2	15 2	12 years—1852-1863.
5	Mixed Mineral Manure alone, every year . . . . .	18 3 $\frac{1}{4}$	18 0 $\frac{1}{4}$	18 1 $\frac{1}{2}$	
10a	Ammonia-salts alone, every year . . . . .	23 1	22 0	22 2 $\frac{1}{2}$	
7	Ammonia-salts and Mixed Mineral Manure, every year . . . . .	35 0 $\frac{1}{2}$	37 2 $\frac{1}{2}$	36 1 $\frac{1}{2}$	
2	14 tons Farmyard Manure, every year . . . . .	33 1 $\frac{1}{4}$	37 1 $\frac{1}{2}$	35 1 $\frac{1}{2}$	
Weight per Bushel of Dressed Corn, in lbs.					
3	Unmanured, every year . . . . .	58·3	57·6	57·9	20 years—1844-1863.
10a	Ammonia-salts alone, every year . . . . .	58·7	56·6	57·6	19 years—1845-1863.
2	14 tons Farmyard Manure, every year . . . . .	59·8	60·3	60·0	20 years—1844-1863.
3	Unmanured, every year . . . . .	55·8	57·2	56·5	12 years—1852-1863.
5	Mixed Mineral Manure alone, every year . . . . .	57·1	58·7	57·9	
10a	Ammonia-salts alone, every year . . . . .	55·9	55·8	55·9	
7	Ammonia-salts and Mixed Mineral Manure, every year . . . . .	57·9	58·9	58·4	
2	14 tons Farmyard Manure, every year . . . . .	58·8	59·8	59·3	
Total Corn, per Acre, in lbs.					
3	Unmanured, every year . . . . .	1018	1035	1026	20 years—1844-1863.
10a	Ammonia-salts alone, every year . . . . .	1628	1527	1575	19 years—1845-1863.
2	14 tons Farmyard Manure, every year . . . . .	1737	2395	2076	20 years—1844-1863.
3	Unmanured, every year . . . . .	963	965	964	12 years—1852-1863.
5	Mixed Mineral Manure alone, every year . . . . .	1171	1144	1157	
10a	Ammonia-salts alone, every year . . . . .	1463	1408	1435	
7	Ammonia-salts and Mixed Mineral Manure, every year . . . . .	2195	2356	2275	
2	14 tons Farmyard Manure, every year . . . . .	2102	2362	2232	
Total Straw (and Chaff), per Acre, in lbs.					
3	Unmanured, every year . . . . .	1693	1693	1693.	20 years—1844-1863.
10a	Ammonia-salts alone, every year . . . . .	2846	2640	2737	19 years—1845-1863.
2	14 tons Farmyard Manure, every year . . . . .	3071	3960	3515	20 years—1844-1863.
3	Unmanured, every year . . . . .	1678	1645	1662	12 years—1852-1863.
5	Mixed Mineral Manure alone, every year . . . . .	2012	1783	1898	
10a	Ammonia-salts alone, every year . . . . .	2693	2513	2603	
7	Ammonia-salts and Mixed Mineral Manure, every year . . . . .	4233	4190	4212	
2	14 tons Farmyard Manure, every year . . . . .	3794	3944	3869	
Total Produce (Corn and Straw), per Acre, in lbs.					
3	Unmanured, every year . . . . .	2711	2728	2719	20 years—1844-1863.
10a	Ammonia-salts alone, every year . . . . .	4474	4166	4312	19 years—1845-1863.
2	14 tons Farmyard Manure, every year . . . . .	4828	6355	5591	20 years—1844-1863.
3	Unmanured, every year . . . . .	2641	2610	2626	12 years—1852-1863.
5	Mixed Mineral Manure alone, every year . . . . .	3183	2927	3055	
10a	Ammonia-salts alone, every year . . . . .	4156	3921	4038	
7	Ammonia-salts and Mixed Mineral Manure, every year . . . . .	6428	6546	6487	
2	14 tons Farmyard Manure, every year . . . . .	5896	6306	6101	

though a diminution in the produce of straw, still some increase of total produce, during the later years. Finally, with farmyard-manure there is an increase of both corn and straw in the latter as compared with the former half of the twelve years, but in a much less degree than over the last ten as compared with the first ten years of the whole period of the experiments.

The general result over the final twelve years is, then, that the average annual yield was, without manure, much the same over the whole period; that, notwithstanding the exhausting effects of applying ammonia-salts every year, the annual diminution of produce under their influence was proportionally less during the latter half of the last twelve, than of the whole nineteen years of their use; that where ammonia-salts and all mineral constituents, except silica, were liberally supplied every year, the produce of corn increased, and that of the straw somewhat diminished; lastly, that where an excess of every constituent required by the crop was annually applied, as in the farmyard manure, the rate of increase from year to year was not so great during the later as during some of the earlier years.

That the unmanured produce should keep up its yield during the later years, and that the produce by the exhaustive process of applying ammonia-salts every year should diminish less during the latter half of the twelve than of the whole nineteen years, seems sufficient indication that the later seasons of the experiments were, upon the whole, more favourable than the earlier ones. But to this evidence may be added that derivable from the fact, that although the average weight per bushel of dressed corn without manure, and with ammonia-salts alone, was considerably less during the latter than during the earlier half of the whole period, it was, nevertheless, without manure considerably higher, and with ammonia-salts alone about as high, during the latter as during the earlier half of the last twelve years. It is, therefore, clear, that even under the most defective soil conditions the crop has either not deteriorated, or has done so in a less degree, in the later years.

Upon the whole, then, it must be concluded, that the later years of the experimental period were, on the average, slightly more favourable to the crop than the earlier ones. Assuming this to have been the case, it must be admitted, that the fact of the unmanured plot maintaining its produce throughout the whole twenty years is probably in some degree due to the better average of the seasons themselves in the later years; and, consequently, that had it been otherwise, the unmanured produce would have shown some slight decline in the later years, or rather, some slight



excess in the earlier ones, due to the accumulation of many previous courses of manuring and cropping.

These few illustrations will serve to indicate the degree, or limit, of the influence of any slight progressive improvement in the character of the seasons of the experimental period, and thus prepare the way for considering the effects of accumulation, or exhaustion, of constituents, from the manuring and cropping of preceding, on the produce of succeeding years.

*(To be continued.)*

APPENDIX.—TABLES.

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF  
APPENDIX.—TABLE I.—MANURES and PRODUCE; 1ST SEASON, 1843-4.

Plots.	MANURES PER ACRE.								
	Farmyard Manure.	Farmyard Manure Ashes.	Silicate of Potass. <sup>2</sup>	Phosphate of Potass. <sup>3</sup>	Phosphate of Soda. <sup>3</sup>	Phosphate of Magnesia. <sup>3</sup>	Super- phosphate of Lime. <sup>3</sup>	Sulphate of Ammonia.	Rape Cake.
	Tons.	Cwts.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	Mixture of the residue of most of the other manures						..	..	..
1	..	..	..	..	..	..	700	..	154
2	14	..	..	..	..	..	..	..	..
3	Unmanured		..	..	..	..	..	..	..
4	..	32 <sup>1</sup>	..	..	..	..	..	..	..
5	..	..	..	..	..	..	700	..	..
6	..	..	..	..	..	420	350	..	..
7	..	..	..	..	325	..	350	..	..
8	..	..	..	375	..	..	350	..	..
9	..	..	..	..	..	..	630	65	..
10	..	..	220	..	..	..	560	..	..
11	..	..	..	..	..	..	350	..	308
12	..	..	..	..	162½	210	350	..	..
13	..	..	..	187½	..	210	350	..	..
14	..	..	275	..	..	210	350	..	..
15	..	..	110	150	..	168	350	..	..
16	..	..	110	75	65	84	350	65	..
17	..	..	110	75	65	84	350 <sup>4</sup>	65	..
18	..	..	110	75	65	84	350	65	154
19	..	..	110	..	81	105	350	81	..
20	Unmanured		..	..	..	..	..	..	..
21 } 22 }	Mixture of the residue of most of the other manures						..	..	..

<sup>1</sup> The farmyard dung was burnt slowly in a heap in the open air to an imperfect or coaly ash, and 32 cwts. of ash represent 14 tons of dung.

<sup>2</sup> The silicate of potass was manufactured at a glass-house by fusing equal parts of pearl-ash and sand. The product was a transparent glass, slightly deliquescent in the air, which was ground to powder under edge-stones.

<sup>3</sup> The manures termed superphosphate of lime, phosphate of potass, phosphate of soda, and phosphate of magnesia, were made by acting upon bone-ash by means of sulphuric acid in the first instance, and in the cases of the alkali salts and the magnesian one neutralizing the compound thus obtained by means of cheap preparations of the respective bases. For the superphosphate of lime the proportions were 5 parts bone-ash, 3 parts water, and 3 parts sulphuric acid of sp. gr. 1·84; and for the phosphates of potass, soda, and magnesia, they were 4 parts bone-ash, water as needed, 3 parts sulphuric acid of sp. gr. 1·84, and equivalent amounts, respectively, of pearl-ash,

## WHEAT YEAR AFTER YEAR ON THE SAME LAND.

MANURES and SEED (Old Red Lammas) sown Autumn 1843.

Plots.	PRODUCE PER ACRE, &c.							INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to. 100 Straw.
	Dressed Corn.		Offal Corn. <sup>5</sup>	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity. <sup>5</sup>	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	19	3 $\frac{3}{4}$	58.5	61	1228	1436	2664	305	316	621	..	85.5
1	16	3	59.0	52	1040	1203	2243	117	83	200	..	86.4
2	20	1 $\frac{3}{4}$	59.3	64	1276	1476	2752	353	356	709	..	86.4
3	15	0	58.5	46	923	1120	2043	..	..	..	..	82.4
4	14	2 $\frac{1}{4}$	58.0	44	888	1104	1992	-35	-16	-51	..	80.4
5	15	2 $\frac{1}{2}$	58.3	48	956	1116	2072	33	-4	29	..	85.6
6	15	1	60.0	48	964	1100	2064	41	-20	21	..	87.6
7	15	2	60.3	49	984	1172	2156	61	52	113	..	84.0
8	15	0 $\frac{3}{4}$	61.3	49	980	1160	2140	57	40	97	..	84.5
9	19	2 $\frac{1}{2}$	62.3	64	1280	1368	2648	357	248	605	..	93.5
10	15	1 $\frac{3}{4}$	62.0	50	1008	1112	2120	85	-8	77	..	90.6
11	17	0 $\frac{3}{4}$	61.8	56	1116	1200	2316	193	80	273	..	93.0
12	15	2	61.5	50	1004	1116	2120	81	-4	77	..	90.0
13	16	1 $\frac{1}{4}$	62.5	54	1072	1204	2276	149	84	233	..	89.0
14	15	3	61.3	51	1016	1176	2192	93	56	149	..	86.4
15	16	3 $\frac{1}{4}$	62.0	55	1096	1240	2336	173	120	293	..	88.4
16	19	3 $\frac{1}{4}$	62.5	65	1304	1480	2784	381	360	741	..	88.1
17	18	3 $\frac{3}{4}$	62.3	62	1240	1422	2662	317	302	619	..	87.2
18	20	3 $\frac{3}{4}$	62.0	68	1368	1768	3136	445	648	1093	..	77.4
19	24	1 $\frac{1}{2}$	61.8	79	1580	1772	3352	657	652	1309	..	89.2
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..

soda-ash, or a mixture of 1 part medicinal carbonate of magnesia and 4 parts magnesian limestone. The mixtures, of course, all lost weight considerably by the evolution of water and carbonic acid.

<sup>4</sup> Made with unburnt bones.

<sup>5</sup> In this first season neither the weight nor the measure of the offal corn was recorded separately; and in former papers the bushels and pecks of total corn (including offal) have erroneously been given as dressed corn. To bring the records more in conformity with those relating to the other years, 5 per cent., by weight, has been deducted from the total corn previously stated as dressed corn, and is recorded as offal corn; this being about the probable proportion, judging from the character of the season, the bulk of the crop, and the weight per bushel of the dressed corn. Although not strictly correct, the statements of dressed corn as amended in this somewhat arbitrary way will approximate more nearly to the truth, and be more comparable with those relating to other seasons, than those hitherto recorded.

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF  
APPENDIX.—TABLE II.—MANURES and PRODUCE; 2ND SEASON, 1845.

Plots.	MANURES PER ACRE.											
	Farm-yard Manure.	Silicate of Potass. <sup>1</sup>	Phosphate of Potass. <sup>2</sup>	Superphosphate of Lime. <sup>2</sup>	Bone-ash.	Muriatic Acid.	Guano.	Sulphate of Ammonia.	Muriate of Ammonia. <sup>3</sup>	Carbonate of Ammonia.	Rape Cake.	Tapioca.
	Tons.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	Mixture of the residue of most of the other manures								..	..	..	..
1	..	112	..	..	..	..	..	224	..	..	560	..
2	14	..	..	..	..	..	..	..	..	..	..	..
3	Unmanured		..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	112	112	..	112	..	..	..	..
5	1 2 Unmanured		..	..	..	..	..	..	..	..	..	..
			..	..	..	..	..	..	..	252 <sup>3</sup>	..	..
6	..	..	..	112	..	..	..	112	..	..	560	..
7	..	..	..	112	..	..	..	112	..	..	..	560
8	..	..	..	..	..	..	..	112	..	..	560	..
9	..	..	..	..	..	..	..	168 <sup>5</sup>	168 <sup>5</sup>	..	..	..
10	..	..	..	..	..	..	..	168 <sup>6</sup>	168 <sup>6</sup>	..	..	..
11	..	..	..	280	..	..	..	224 <sup>6</sup>	..	..	560	..
12	..	..	280	..	..	..	..	224	..	..	560	..
13	..	..	..	..	..	..	336 <sup>7</sup>	..	..	..	..	..
14	..	..	..	..	..	..	672 <sup>8</sup>	..	..	..	..	..
15	..	..	..	..	224	224	..	224	..	..	..	..
16	..	..	..	224	..	..	..	56	56	..	560	..
17	..	..	..	224	..	..	..	112	112	..	280	..
18	..	..	..	336	..	..	..	112	112	..	..	..
19	..	..	..	..	112	112	..	112	..	..	336	..
20	Unmanured		..	..	..	..	..	..	..	..	..	..
21	Mixture of the residue of most of the other manures										..	..
22											..	..

<sup>1</sup> The silicate of potass was manufactured at a glass-house by fusing equal parts of pearl-ash and sand. The product was a transparent glass, slightly deliquescent in the air; it was ground to powder under edge-stones.

<sup>2</sup> The manures termed superphosphate of lime and phosphate of potass were made by acting upon bone-ash by means of sulphuric acid, and in the case of the potass salt neutralizing the compound thus obtained by means of pearl-ash. For the superphosphate of lime the proportions were 5 parts bone-ash, 3 parts water, and 3 parts sulphuric acid of sp. gr. 1·84; and for the phosphate of potass 4 parts bone-ash, water as needed, 3 parts sulphuric acid of sp. gr. 1·84, and an equivalent amount of pearl-ash. The mixtures, of course, lost weight considerably by the evolution of water and carbonic acid.



## WHEAT YEAR AFTER YEAR ON THE SAME LAND.

MANURES and SEED (Old Red Lammas) sown March 1845.

Plots.	PRODUCE PER ACRE, &c.						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.									
	Bush. Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	32 0	56·5	159	1967	3977	5944	526	1265	1791	10·9	49·5
1	26 1¼	54·8	248	1689	3699	5388	248	987	1235	17·3	45·7
2	32 0	56·8	151	1967	3915	5882	526	1203	1729	8·9	50·2
3	23 0¾	56·5	131	1441	2712	4153	..	..	..	8·7	53·1
4	29 2½	58·0	161	1879	3663	5542	438	951	1389	9·4	51·3
5	22 2¼	57·5	134	1431	2684	4115	-10	-28	-38	10·1	53·3
	26 3¾	57·3	190	1732	3599	5331	291	887	1178	14·2	48·1
6	28 2¾	57·8	214	1871	3644	5515	430	932	1362	14·1	57·3
7	26 2¾	57·0	161	1682	3243	4925	241	531	772	11·3	51·9
8	27 0¼	56·3	194	1716	3663	5379	275	951	1226	14·0	46·9
9	33 1½	58·3	187	2131	4058	6189	690	1346	2036	10·2	52·5
10	31 ¾	56·3	191	1980	4266	6246	539	1554	2093	12·3	46·4
11	30 3	56·0	158	1880	4104	5984	439	1392	1831	11·3	45·8
12	28 2½	55·3	264	1842	4134	5976	401	1422	1823	17·8	44·5
13	25 0	56·3	152	1558	3355	4913	117	643	760	12·0	46·4
14	27 1	57·5	176	1743	3696	5439	302	984	1286	16·2	47·1
15	32 ¾	57·5	209	2103	4044	6147	662	1332	1994	11·8	52·0
16	32 ¾	56·3	182	2028	4191	6219	587	1479	2066	11·1	48·4
17	32 0¾	55·8	299	2093	3826	5919	652	1114	1766	15·2	54·7
18	33 0¼	56·5	180	2048	3819	5867	607	1107	1714	11·2	53·6
19	34 3	57·0	133	2114	4215	6329	673	1503	2176	9·1	50·2
20	24 2¾	56·0	113	1495	3104	4599	54	392	446	9·7	48·2
21	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..

<sup>3</sup> The medicinal carbonate of ammonia; it was dissolved in water and top-dressed.<sup>4</sup> Plot 5 was 2 lands wide (in after years, respectively, 5a and 5b); 5<sup>1</sup> consisting of 2 alternate one-fourth lengths across both lands, and 5<sup>2</sup> of the 2 remaining one-fourth lengths.<sup>5</sup> Top-dressed at once.<sup>6</sup> Top-dressed at 4 intervals.<sup>7</sup> Peruvian.<sup>8</sup> Ichaboe.

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF  
APPENDIX.—TABLE III.—MANURES AND PRODUCE; 3RD SEASON, 1845-6.

MANURES PER ACRE.														
Plots.	Farm- yard Manure.	Ash from 3 loads (3888 lbs.) Wheat- straw.	Liebig's Wheat- manure.	Peru- vian Guano.	Silicate of Potass.	Pearl- ash.	Soda- ash.	Mag- nesian Lime- stone.	Superphosphate of Lime.			Sulphate of Ammo- nia.	Muriate of Ammo- nia.	Rape Cake.
									Bone- Ash.	Sul- phuric Acid (Sp. gr. 1·7.)	Muri- atic Acid.			
	Tons.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	..	..	..	336	..	..	..	..	..	..	..	..	..	..
1	..	..	..	..	..	..	..	..	224	..	..	..	..	..
2	14	..	..	..	..	..	..	..	..	..	..	..	..	..
3	Unmanured		..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	224	..	224	224	..	..
5a	12	Straw- ash.	{	..	..	..	..	..	..	..	..	224 <sup>1</sup>	..	..
5b				..	..	..	..	..	..	..	..	224 <sup>1</sup>	..	448
6a				..	..	..	..	..	..	..	..	..	..	..
6b				..	..	..	..	..	..	..	..	112	112	..
7a	..	..	448	..	..	..	..	..	..	..	..	..	..	448
7b	..	..	448	..	..	..	..	..	..	..	..	112	112	448
8a	..	..	..	..	..	..	..	..	224	..	..	..	..	448
8b	..	..	..	..	..	..	..	..	224	..	..	112	112	..
9a	..	..	..	..	..	..	..	..	..	..	..	..	..	448
9b	..	..	..	..	..	..	..	..	..	..	..	224	..	448
10a	..	..	..	..	..	..	..	..	..	..	..	224	..	..
10b	Unmanured		..	..	..	..	..	..	..	..	..	..	..	..
11a	..	..	..	..	..	..	..	..	224	224	..	..	..	448
11b	..	..	..	..	..	..	..	..	224	224	..	112	112	..
12a	..	..	..	..	..	..	180	..	224	224	..	..	..	448
12b	..	..	..	..	..	..	180	..	224	224	..	112	112	..
13a	..	..	..	..	..	200	..	..	224	224	..	..	..	448
13b	..	..	..	..	..	200	..	..	224	224	..	112	112	..
14a	..	..	..	..	..	..	..	84	224	224	..	..	..	448
14b	..	..	..	..	..	..	..	84	224	224	..	112	112	..
15a	..	..	..	..	..	..	..	..	224	..	224	224	..	448
15b	..	..	..	..	224	..	..	..	224	..	224	224	..	448
16a	..	..	..	..	..	67	60	84	224	224	..	..	..	448
16b	..	..	..	..	..	67	60	84	224	224	..	224	..	448
17a	..	..	..	..	..	67	60	84	224	224	..	112	112	448
17b	..	..	..	..	..	67	60	84	224	224	..	224	..	..
18a	..	..	..	..	..	67	60	84	224	224	..	112	112	..
18b	..	..	..	..	..	67	60	84	224	224	..	..	..	..
19	..	..	..	..	..	..	..	..	112	..	112	112	..	448
20	Mixture of the residue of most of the other manures									..	..	..	..	..
21										..	..	..	..	..
22										..	..	..	..	..

<sup>1</sup> Top-dressed in the Spring.

WHEAT YEAR AFTER YEAR ON THE SAME LAND.

MANURES and SEED (Old Red Lammias) sown Autumn 1845.

Plots.	PRODUCE PER ACRE, &c.						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.									
	Bush. Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	28 1 3/4	62.3	134	1906	2561	4467	699	1048	1747	7.3	74.4
1	22 0 1/2	62.6	120	1509	1953	3462	302	440	742	8.1	77.3
2	27 0 3/4	63.0	113	1826	2454	4280	619	941	1560	6.6	74.4
3	17 3 3/4	63.8	64	1207	1513	2720	..	..	..	7.4	79.7
4	25 3 3/4	63.5	130	1777	2390	4167	570	877	1447	7.8	74.3
5a {	19 0 1/2	63.7	87	1305	1541	2846	98	28	126	..	84.6
5b {	27 0	63.0	126	1827	2309	4136	620	796	1416	..	79.1
6a {	23 2 1/2	63.4	100	1598	1721	3319	391	208	599	..	92.8
6b {	30 0 3/4	63.3	165	2076	2901	4977	869	1388	2257	..	71.6
7a	20 1 1/2	63.7	102	1400	1676	3076	193	163	356	7.0	83.6
8a	29 0 3/4	63.5	114	1967	2571	4538	760	1058	1818	5.3	76.5
9a	22 3 1/4	63.0	97	1534	1968	3502	327	405	732	6.8	77.9
10a	31 3	63.4	150	2163	3007	5170	956	1494	2450	7.5	72.6
11a	22 3 1/4	63.5	101	1549	1963	3512	342	450	792	7.1	78.9
11b	29 0 3/4	63.6	132	1988	2575	4563	781	1062	1843	7.2	77.2
12a	23 2 3/4	63.0	122	1614	2033	3647	407	520	927	7.9	79.4
12b	28 3 1/2	63.3	114	1942	2603	4545	735	1090	1825	7.0	74.6
13a	27 1 1/2	63.6	109	1850	2244	4094	643	731	1374	6.4	82.4
13b	17 2 1/2	63.8	92	1216	1455	2671	9	-58	-49	7.8	83.6
14a	23 1 3/4	63.3	145	1628	2133	3761	421	620	1041	9.8	76.3
14b	30 0 1/4	63.2	155	2055	2715	4770	848	1202	2050	6.1	75.7
15a	24 1 1/2	63.0	125	1661	2163	3824	454	650	1104	7.9	76.8
15b	28 2 1/2	63.4	136	1955	2554	4509	748	1041	1789	7.4	76.5
16a	24 0	63.5	136	1660	2327	3987	453	814	1267	9.1	71.3
16b	29 1 3/4	63.2	138	1998	2755	4753	791	1242	2033	7.3	72.5
17a	23 2 1/2	63.0	117	1605	2031	3636	398	518	916	7.7	79.0
17b	26 2 1/2	63.4	124	1812	2534	4356	605	1021	1626	7.4	71.5
18a	31 1 3/4	62.5	147	2112	2936	5048	905	1423	2328	7.5	71.9
18b	27 2 3/4	63.0	117	1861	2513	4374	654	1000	1654	5.9	74.0
19a	23 3	62.5	108	1592	2067	3659	385	554	939	7.0	77.0
19b	30 1	62.7	122	2019	2836	4855	812	1323	2135	6.6	71.2
20a	33 2 3/4	62.8	129	2241	3278	5519	1034	1765	2799	5.8	68.3
20b	30 2	63.0	113	2034	2784	4818	827	1271	2098	5.9	73.0
21a	31 0	62.8	103	2048	2838	4886	841	1325	2166	5.1	72.2
21b	21 1	62.0	157	1474	1893	3367	267	380	647	6.6	77.1
22	28 3	62.0	107	1889	2425	4314	682	912	1594	5.8	77.9
23	..	..	..	..	..	..	..	..	..	..	..

## EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF

APPENDIX.—TABLE IV.—MANURES and PRODUCE; 4TH SEASON, 1846-7.

[illegible]



WHEAT YEAR AFTER YEAR ON THE SAME LAND.

MANURES and SEED (Old Red Lammas) sown end of October 1846.

Plots.	PRODUCE PER ACRE, &c.							INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.			Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.										
	Bush.	Fks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	30	2 $\frac{3}{4}$	61.1	156	2031	3277	5308	908	1375	2283	8.2	61.9
1	32	1	61.2	147	2119	3735	5854	996	1833	2829	7.2	56.7
2	29	3 $\frac{3}{4}$	62.3	117	1981	3628	5609	858	1726	2584	6.2	54.6
3	16	3 $\frac{1}{2}$	61.0	95	1123	1902	3025	..	..	..	8.9	59.0
4	27	1 $\frac{3}{4}$	61.9	82	1780	2948	4728	657	1046	1703	4.7	60.3
5a	29	0	61.8	130	1921	3412	5333	798	1510	2309	7.1	56.3
5b	32	2	61.4	136	2132	3721	5853	1009	1819	2827	6.6	57.2
6a	24	3 $\frac{1}{4}$	62.1	122	1663	2786	4449	540	884	1424	7.8	59.6
6b	24	1 $\frac{3}{4}$	61.6	127	1632	2803	4435	509	901	1410	8.2	58.2
7a	27	3 $\frac{1}{4}$	61.7	118	1834	3151	4985	711	1249	1960	6.8	58.2
7b	25	1 $\frac{1}{4}$	61.5	125	1682	2953	4635	559	1051	1610	7.9	56.9
8a	32	1 $\frac{3}{4}$	62.1	102	2115	3683	5798	992	1781	2773	5.5	57.4
8b	30	3	61.7	123	2020	3720	5740	897	1818	2715	6.3	54.3
9a	22	3	62.5	..	1477	2506	3983	228	604	..	..	53.9
9b	26	2	61.0	..	1755	3052	4807	632	1150	..	..	57.5
9b	26	0	61.3	123	1717	2858	4575	594	956	1550	..	60.1
10a	25	3	61.5	118	1702	2891	4593	579	989	1568	7.3	58.8
10b	25	2 $\frac{3}{4}$	61.2	133	1705	2874	4579	582	972	1554	8.2	59.3
11a	30	3 $\frac{1}{4}$	61.6	142	2044	3517	5561	921	1615	2536	6.3	59.5
11b	29	1 $\frac{3}{4}$	61.8	123	1941	3203	5144	818	1301	2119	6.7	60.6
12a	29	2	62.0	124	1953	3452	5405	830	1550	2380	6.6	57.1
12b	27	0 $\frac{1}{2}$	61.8	121	1796	3124	4920	673	1222	1895	7.1	57.4
13a	29	2 $\frac{3}{4}$	62.5	108	1959	3306	5265	836	1404	2240	5.5	57.3
13b	27	1 $\frac{1}{2}$	62.3	96	1801	3171	4972	678	1269	1947	5.3	56.7
14a	28	0 $\frac{3}{4}$	62.8	175	1944	3362	5306	821	1460	2281	9.7	59.5
14b	26	3 $\frac{1}{4}$	62.8	166	1856	3006	4862	733	1104	1837	9.8	61.7
15a	32	3	63.0	151	2214	3876	6090	1091	1974	3065	7.2	57.1
15b	32	0	62.6	137	2140	3617	5757	1017	1715	2732	6.6	59.1
16a	29	1 $\frac{1}{4}$	62.3	132	1959	3417	5376	836	1515	2351	6.9	57.3
16b	34	2 $\frac{1}{4}$	62.6	119	2283	4012	6295	1160	2110	3270	5.2	56.9
17a	33	3	62.3	119	2222	4027	6249	1099	2125	3224	5.6	55.1
17b	35	1 $\frac{3}{4}$	62.0	117	2314	4261	6575	1191	2359	3550	6.4	54.3
18a	32	0 $\frac{3}{4}$	62.7	142	2160	3852	6012	1037	1950	2987	6.9	56.0
18b	29	1 $\frac{1}{2}$	62.9	181	2029	4164	6193	906	2262	3168	9.7	48.7
19	32	3	62.8	140	2195	4202	6397	1072	2300	3372	6.7	52.2
20	20	0 $\frac{3}{4}$	62.5	70	1332	2074	3406	209	172	381	4.9	64.2
21	}	..	..	..	..	..	..	..	..	..	..	..
22		..	..	..	..	..	..	..	..	..	..	..

## EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF

APPENDIX.—TABLE V.—MANURES and PRODUCE; 5TH SEASON, 1847-8.

[illegible]

### WHEAT YEAR AFTER YEAR ON THE SAME LAND.

MANURES and SEED (Old Red Lammas) sown Autumn 1847.

Plots.	PRODUCE PER ACRE, &c.						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity.	Weight per Bushel.										
	Bush.	Pks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
0	19	0 $\frac{3}{4}$	58.4	138	1259	2074	3333	307	362	669	13.4	60.7
1	16	0 $\frac{3}{4}$	59.6	160	1124	1735	2859	172	23	195	16.3	64.7
2	25	2 $\frac{3}{4}$	58.2	210	1705	3041	4746	753	1329	2082	13.8	56.0
3	14	3	57.3	106	952	1712	2664	..	..	..	12.1	55.6
4	24	0 $\frac{1}{2}$	58.5	172	1583	2713	4296	631	1001	1632	12.0	58.3
5a	29	3 $\frac{1}{2}$	59.2	144	1911	3266	5177	959	1554	2513	7.9	58.5
5b	30	3 $\frac{1}{2}$	59.1	107	1932	3533	5465	980	1821	2801	5.8	57.5
6a	24	3 $\frac{1}{4}$	58.8	214	1672	2878	4550	720	1166	1886	14.6	58.0
6b	26	3	56.9	216	1737	2968	4705	785	1256	2041	14.0	58.5
7a	30	3 $\frac{1}{4}$	59.4	106	1936	3088	5024	984	1376	2360	5.7	62.6
7b	29	3 $\frac{1}{4}$	59.6	187	1963	3413	5376	1011	1701	2712	10.3	57.5
8a	19	3	56.2	154	1263	2317	3580	311	605	916	13.6	54.5
8b	19	0 $\frac{3}{4}$	59.4	127	1267	2148	3415	315	436	751	11.1	58.8
9a	18	2 $\frac{1}{2}$	56.7	125	1181	1945	3126	229	233	462	11.6	60.7
9b	25	0 $\frac{1}{4}$	58.3	208	1669	2918	4587	717	1206	1923	13.9	57.1
10a	19	1	58.1	215	1334	2367	3701	382	655	1037	19.0	56.3
10b	25	0 $\frac{1}{4}$	57.8	155	1604	2926	4530	652	1214	1866	10.6	54.8
11a	29	1 $\frac{1}{2}$	59.6	233	1984	3274	5258	1032	1562	2594	13.1	60.6
11b	24	3	57.9	207	1641	2898	4539	689	1186	1875	14.1	56.4
12a	29	3	59.3	174	1938	3390	5328	986	1678	2664	9.3	57.2
12b	26	0 $\frac{3}{4}$	59.2	167	1717	2880	4597	765	1168	1933	10.7	59.6
13a	29	1 $\frac{1}{2}$	57.9	253	1955	3290	5245	1003	1578	2581	14.7	59.4
13b	25	3 $\frac{1}{4}$	58.4	224	1730	3072	4802	778	1360	2138	14.6	56.3
14a	28	0 $\frac{1}{4}$	58.8	184	1834	3257	5091	882	1545	2427	11.1	56.3
14b	25	2 $\frac{1}{2}$	58.5	227	1726	2897	4623	774	1185	1959	15.1	59.5
15a	22	3 $\frac{1}{2}$	58.1	242	1571	2937	4508	619	1225	1844	18.1	53.4
15b	24	2 $\frac{3}{4}$	56.9	202	1607	3016	4623	655	1304	1959	14.1	53.2
16a	29	3 $\frac{1}{4}$	60.0	184	1973	3115	5088	1021	1403	2424	10.2	63.3
16b	30	1 $\frac{3}{4}$	58.4	171	1948	3380	5328	996	1668	2664	9.4	57.6
17a	27	2 $\frac{1}{2}$	59.7	285	1933	3296	5229	981	1584	2565	17.0	58.6
17b	28	3	59.7	222	1946	3324	5270	994	1612	2606	12.6	58.5
18a	26	3	59.2	150	1734	2935	4669	782	1223	2005	9.2	59.0
18b	26	2 $\frac{3}{4}$	59.6	215	1804	3056	4860	852	1344	2196	13.3	58.7
19	29	1 $\frac{3}{4}$	56.2	185	1838	3295	5133	886	1583	2469	10.4	55.7
20	16	0 $\frac{1}{2}$	58.3	111	1050	1721	2771	98	9	107	11.3	61.0
21												
22	..	..	..	..	..	..	..	..	..	..	..	..

## EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF

APPENDIX.—TABLE VI.—MANURES and PRODUCE; 6TH SEASON, 1848-9.

Plots.	MANURES PER ACRE.									
	Farm-yard Manure.	Pearl-ash.	Soda-ash.	Sulphate of Magnesia.	Superphosphate of Lime.			Sulphate of Ammonia.	Muriate of Ammonia.	Rape Cake.
					Bone-ash.	Sulphuric Acid (Sp. gr. 1.7).	Muriatic Acid.			
	Tons.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	..	..	..	..	600	450	..	..	..	..
1	..	600	400	200	..	..	..	..	..	..
2	14	..	..	..	..	..	..	..	..	..
3	Unmanured	..	..	..	..	..	..	..	..	..
4	..	..	..	..	200	..	200	300	..	..
5a	..	300	200	100	200	150	..	250	250	..
5b	..	300	200	100	200	150	..	200	200	500
6a	..	300	200	100	200	150	..	200	200	..
6b	..	300	200	100	200	150	..	200	200	..
7a	..	300	200	100	200	150	..	200	200	..
7b	..	300	200	100	200	150	..	200	200	..
8a	Unmanured	..	..	..	..	..	..	..	..	..
8b	..	..	..	..	..	..	..	..	..	2000
9a	..	..	..	..	..	..	..	..	..	2000
9b	Unmanured	..	..	..	..	..	..	..	..	..
10a	..	..	..	..	..	..	..	200	200	..
10b	..	..	..	..	..	..	..	200	200	..
11a	..	..	..	..	200	150	..	200	200	..
11b	..	..	..	..	200	150	..	200	200	..
12a	..	300	..	..	200	150	..	200	200	..
12b	..	300	..	..	200	150	..	200	200	..
13a	..	300	..	..	200	150	..	200	200	..
13b	..	300	..	..	200	150	..	200	200	..
14a	..	300	..	..	200	150	..	200	200	..
14b	..	300	..	..	200	150	..	200	200	..
15a	..	300	200	100	200	..	200	300	..	..
15b	..	300	200	100	200	..	200	300	..	500
16a	..	300	200	100	200	150	..	200	200	..
16b	..	300	200	100	200	150	..	200	200	..
17a	..	300	200	100	200	150	..	200	200	..
17b	..	300	200	100	200	150	..	200	200	..
18a	..	300	200	100	200	150	..	200	200	..
18b	..	300	200	100	200	150	..	200	200	..
19	..	..	..	..	200	..	200	300	..	500
20	Unmanured	..	..	..	..	..	..	..	..	..
21)	Mixture of the residue of most of the other manures							..	..	..
22)								..	..	..



WHEAT YEAR AFTER YEAR ON THE SAME LAND.

MANURES and SEED (Red Cluster) sown Autumn 1848.

Plots.	PRODUCE PER ACRE, &c.						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity.	Weight per Bushel.										
	Bush.	Pks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
0												
1												
2	31	0	63.8	107	2068	3029	5097	839	1415	2254	4.7	68.3
3	19	1	61.4	47	1229	1614	2843	..	..	..	3.9	76.1
4	30	0	63.0	110	2063	2645	4708	834	1031	1865	5.6	78.0
5a	37	1½	63.1	89	2446	3589	6035	1217	1975	3192	3.7	68.1
5b	39	3½	63.4	97	2651	3824	6475	1422	2210	3632	5.0	69.3
6a	36	1½	63.0	117	2410	3072	5482	1181	1458	2639	5.1	78.4
6b	37	3½	63.0	94	2484	3516	6000	1255	1902	3157	3.9	70.6
7a	38	2½	63.1	137	2576	3584	6160	1347	1970	3317	5.6	71.9
7b	37	3½	62.9	141	2531	3396	5927	1302	1782	3084	5.9	74.5
8a	22	3	61.7	76	1481	1815	3296	252	201	453	5.3	81.6
8b	31	2½	63.0	85	2080	3166	5246	851	1552	2403	4.3	65.7
9a	30	2	62.8	111	2035	2683	4718	896	1069	1875	5.8	75.8
9b	22	1½	62.3	80	1475	1810	3285	246	196	432	5.7	81.5
10a	32	2½	62.3	112	2141	2851	4992	912	1237	2149	5.5	75.1
10b	32	1½	63.3	110	2157	2960	5117	928	1346	2274	5.3	72.9
11a	35	0½	62.6	121	2317	2892	5209	1088	1278	2366	5.6	80.1
11b	32	1½	63.0	112	2149	2942	5091	920	1328	2248	5.5	73.0
12a	35	3½	64.3	93	2396	3371	5767	1167	1757	2924	4.1	71.1
12b	34	1½	64.3	71	2277	3300	5577	1048	1687	2735	3.2	69.0
13a	34	3¾	64.1	101	2340	3236	5576	1111	1622	2733	4.5	72.3
13b	34	2½	64.1	129	2346	3246	5592	1117	1632	2749	5.8	72.3
14a	34	1½	64.3	56	2266	3211	5477	1037	1597	2634	2.5	70.6
14b	31	1½	64.3	112	2123	3218	5341	894	1604	2498	5.5	66.0
15a	31	3½	64.2	65	2109	3038	5147	880	1424	2304	3.2	69.4
15b	30	0¾	64.1	68	2005	3262	5267	776	1648	2424	3.5	61.5
16a	33	1½	64.5	101	2254	3384	5638	1025	1770	2795	4.7	66.6
16b	33	3½	64.6	75	2268	3559	5827	1039	1945	2984	3.4	63.7
17a	34	1	64.3	111	2316	3891	6207	1087	2277	3364	5.1	59.4
17b	33	1½	64.4	112	2259	3858	6117	1030	2244	3274	5.2	58.5
18a	32	1½	64.0	93	2163	3592	5755	934	1978	2912	4.5	60.2
18b	33	2½	64.0	95	2243	3779	6022	1014	2165	3179	4.4	59.3
19	29	2½	63.9	102	1994	3270	5264	765	1656	2421	5.4	61.0
20												
21												
22												

## EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF

APPENDIX.—TABLE VII.—MANURES and PRODUCE ; 7TH SEASON, 1849-50. After the  
MANURES and SEED (Red Cluster)

Plots.	MANURES PER ACRE.									
	Farm- yard Manure.	Pearl-ash.	Soda-ash.	Sulphate of Magnesia.	Superphosphate of Lime.			Sulphate of Ammonia.	Muriate of Ammonia.	Rape Cake.
					Bone-ash.	Sulphuric Acid (Sp. gr. 1·7).	Muriatic Acid.			
	Tons.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	..	..	..	..	600	450	..	..	..	..
1	..	600	400	200	..	..	..	..	..	..
2	14	..	..	..	..	..	..	..	..	..
3	Unmanured	..	..	..	..	..	..	..	..	..
4	..	..	..	..	200	..	200	300	..	..
5a	..	300	200	100	200	150	..	250	250	..
5b	..	300	200	100	200	150	..	250	250	..
6a	..	300	200	100	200	150	..	200	200	..
6b	..	300	200	100	200	150	..	200	200	..
7a	..	300	200	100	200	150	..	200	200	500
7b	..	300	200	100	200	150	..	200	200	500
8a	..	..	..	..	..	..	..	200	200	..
8b	..	..	..	..	..	..	..	200	200	..
9a	..	..	..	..	..	..	..	200	200	..
9b	..	..	..	..	..	..	..	200	200	..
10a	..	..	..	..	..	..	..	200	200	..
10b	..	300	200	100	200	150	..	..	..	..
11a	..	..	..	..	200	150	..	200	200	..
11b	..	..	..	..	200	150	..	200	200	..
12a	..	300	..	..	200	150	..	200	200	..
12b	..	300	..	..	200	150	..	200	200	..
13a	..	300	..	..	200	150	..	200	200	..
13b	..	300	..	..	200	150	..	200	200	..
14a	..	300	..	..	200	150	..	200	200	..
14b	..	300	..	..	200	150	..	200	200	..
15a	..	300	200	100	200	..	200	300	..	..
15b	..	300	200	100	200	..	200	300	..	500
16a	..	300	200	100	200	150	..	200	200	..
16b	..	300	200	100	200	150	..	200	200	..
17a	..	300	200	100	200	150	..	200	200	..
17b	..	300	200	100	200	150	..	200	200	..
18a	..	300	200	100	200	150	..	200	200	..
18b	..	300	200	100	200	150	..	200	200	..
19	..	..	..	..	200	..	200	300	..	500
20	Unmanured	..	..	..	..	..	..	..	..	..
21)	Mixture of the residue of most of the other manures							..	..	..
22)								..	..	..



EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF  
APPENDIX.—TABLE VIII.—MANURES AND PRODUCE; 8TH SEASON,

Plots.	MANURES PER ACRE.											
	Farm- yard Manure.	Cut Wheat- straw and Chaff.	Common Salt.	Sulphate of Potass.	Soda- ash.	Sulphate of Mag- nesia.	Superphosphate of Lime.			Sulphate of Ammo- nia.	Muriate of Ammo- nia.	Rape Cake.
							Bone- ash.	Sul- phuric Acid (Sp. gr. 1.7).	Muriatic Acid.			
	Tons.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	..	..	..	..	..	..	600	450	..	..	..	..
1	..	..	..	600	400	200	..	..	..	..	..	..
2	14	..	..	..	..	..	..	..	..	..	..	..
3	Unmanured		..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	200	..	200	400	..	..
5a	..	..	..	300	200	100	200	150	..	300	300	..
5b	..	..	..	300	200	100	200	150	..	300	300	..
6a	..	..	..	300	200	100	200	150	..	200	200	..
6b	..	..	..	300	200	100	200	150	..	200	200	..
7a	..	..	..	300	200	100	200	150	..	200	200	1000
7b	..	..	..	300	200	100	200	150	..	200	200	1000
8a	..	5000	..	..	..	..	..	..	..	..	..	..
8b	..	..	..	300	200	100	200	150	..	100	100	..
9a	..	..	..	..	..	..	..	..	..	200	200	..
9b	..	..	..	..	..	..	..	..	..	200	200	..
10a	..	..	..	..	..	..	..	..	..	200	200	..
10b	..	..	..	..	..	..	..	..	..	200	200	..
11a	..	..	..	..	..	..	200	150	..	200	200	..
11b	..	..	..	..	..	..	200	150	..	200	200	..
12a	..	..	..	200	100	..	200	150	..	200	200	..
12b	..	..	..	200	100	..	200	150	..	200	200	..
13a	..	..	..	300	..	..	200	150	..	200	200	..
13b	..	..	..	300	..	..	200	150	..	200	200	..
14a	..	..	..	200	..	100	200	150	..	200	200	..
14b	..	..	..	200	..	100	200	150	..	200	200	..
15a	..	..	..	200	100	100	200	..	200	400	..	..
15b	..	..	..	200	100	100	200	..	200	300	..	500
16a	..	..	336 <sup>1</sup>	200	100	100	200	150	..	300	300	..
16b	..	..	..	200	100	100	200	150	..	300	300	..
17a	..	..	..	200	100	100	200	150	..	200	200	..
17b	..	..	..	200	100	100	200	150	..	200	200	..
18a	..	..	..	..	..	..	..	..	..	200	200	..
18b	..	..	..	..	..	..	..	..	..	200	200	..
19	..	..	..	..	..	..	200	..	200	300	..	500
20	Unmanured		..	..	..	..	..	..	..	..	..	..
21			..	..	..	..	..	..	..	..	..	..
22			..	..	..	..	..	..	..	..	..	..

<sup>1</sup> Top-dressed in March, 1851.



## WHEAT YEAR AFTER YEAR ON THE SAME LAND.

1850-51. MANURES and SEED (Red Cluster) sown Autumn 1850.

Plots.	PRODUCE PER ACRE, &c.							INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity.	Weight per Bushel.										
	Bush.	Pks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
0	18	3½	61.9	125	1296	1862	3158	213	235	448	10.7	69.6
1	18	1½	61.7	124	1251	1845	3096	168	218	386	11.0	67.8
2	29	2½	63.6	166	2049	3094	5143	966	1467	2433	8.8	66.2
3	15	3½	61.1	114	1083	1627	2710	..	..	..	11.8	66.6
4	28	0½	62.6	159	1919	2949	4868	836	1322	2158	9.0	65.1
5a	36	0	63.3	194	2473	4131	6604	1390	2504	3894	8.6	59.9
5b	37	3¾	63.3	213	2611	4294	6905	1528	2667	4195	8.9	60.8
6a	33	1½	63.3	154	2271	3624	5895	1188	1997	3185	7.2	62.6
6b	31	0½	62.3	189	2119	3507	5626	1036	1880	2916	9.8	60.4
7a	36	3½	63.0	201	2524	4587	7111	1441	2960	4401	8.7	55.0
7b	37	1½	63.0	178	2532	4302	6834	1449	2675	4124	7.6	58.8
8a	26	0¾	62.8	141	1785	2769	4554	702	1142	1844	8.6	64.5
8b	27	2¼	62.6	137	1863	2830	4693	780	1203	1983	7.9	65.8
9a	31	1½	62.4	182	2142	3252	5394	1059	1625	2684	9.3	65.9
9b	29	0½	62.0	170	1970	2942	4912	887	1315	2202	9.5	67.0
10a	28	3½	61.9	179	1966	3070	5036	883	1443	2326	10.0	64.0
10b	28	2½	62.5	149	1937	3048	4985	854	1421	2275	8.3	63.5
11a	32	2¾	62.3	181	2216	3386	5602	1133	1759	2892	8.9	65.4
11b	31	2¾	62.5	181	2163	3302	5465	1080	1675	2755	9.1	65.5
12a	32	3	63.1	165	2234	3600	5834	1151	1973	3124	8.0	62.0
12b	32	2¼	62.5	166	2203	3581	5784	1120	1954	3074	8.2	61.5
13a	30	2½	62.6	180	2102	3544	5646	1019	1917	2936	9.4	59.3
13b	30	3¼	62.3	160	2083	3440	5523	1000	1813	2813	8.3	60.5
14a	31	0½	62.9	168	2120	3605	5725	1037	1978	3015	8.6	58.8
14b	31	0½	62.8	165	2121	3537	5658	1038	1910	2948	8.4	59.9
15a	27	0½	62.7	138	1839	3041	4880	756	1414	2170	8.1	60.5
15b	30	2½	62.7	148	2077	3432	5509	994	1805	2799	7.6	60.5
16a	36	31	63.5	161	2499	4234	6733	1416	2607	4023	6.9	59.0
16b	36	2½	63.4	176	2501	4332	6833	1418	2705	4123	7.6	57.7
17a	31	3½	63.3	131	2149	3597	5746	1066	1970	3036	6.5	59.7
17b	30	2¼	63.1	152	2079	3406	5485	996	1779	2775	7.9	61.0
18a	30	3¼	63.0	139	2083	3390	5473	1000	1763	2763	7.2	64.1
18b	31	0¾	62.4	143	2090	3586	5676	1007	1959	2966	7.3	58.3
19	30	1	62.4	144	2031	3348	5379	948	1721	2669	7.7	60.7
20	14	1	60.8	89	956	1609	2565	-127	-18	-145	10.2	59.4
21	17	3¼	61.9	127	1232	1763	2995	149	136	285	11.5	69.9
22f												

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE IX.—MANURES per Acre per Annum (with the exceptions explained in the Notes on p. 163), for 12 Years in succession—namely, for the 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, and 20th Seasons; that is, for the crops of Harvests 1852-53-54-55-56-57-58-59-60-61-62 and 1863.\*

Plots.	Manures per Acre per Annum for 12 Years, 1851-2 to 1862-3 inclusive, except in the cases explained in the Notes on p. 163.											
	Farm- yard Manure.	Com- mon Salt.	Sulphate of Potass. <sup>1</sup>	Sulphate of Soda. <sup>1</sup>	Sulphate of Mag- nesia. <sup>1</sup>	Superphosphate of Lime.			Sulphate of Ammo- nia.	Muriate of Ammo- nia.	Nitrate of Soda.	Rape Cake.
						Bone- ash.	Sulphuric Acid (Sp. gr. 1·7).	Muriatic Acid.				
	Tons.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	..	..	..	..	..	600	450	..	..	..	..	..
1	..	..	*600	400	200	..	..	..	..	..	..	..
2	14	..	..	..	..	..	..	..	..	..	..	..
3	Unmanured		..	..	..	..	..	..	..	..	..	..
4	Unmanured		..	..	..	..	..	..	..	..	..	..
5a	..	..	300	200	100	200	150	..	..	..	..	..
5b	..	..	300	200	100	200	150	..	..	..	..	..
6a	..	..	300	200	100	200	150	..	100	100	..	..
6b	..	..	300	200	100	200	150	..	100	100	..	..
7a	..	..	300	200	100	200	150	..	200	200	..	..
7b	..	..	300	200	100	200	150	..	200	200	..	..
8a	..	..	300	200	100	200	150	..	300	300	..	..
8b	..	..	300	200	100	200	150	..	300	300	..	..
9a <sup>2</sup>	..	..	300	200	100	200	150	..	..	..	550	..
9b <sup>3</sup>	..	..	..	..	..	..	..	..	..	..	550	..
10a	..	..	..	..	..	..	..	..	200	200	..	..
10b	..	..	..	..	..	..	..	..	200	200	..	..
11a	..	..	..	..	..	200	150	..	200	200	..	..
11b	..	..	..	..	..	200	150	..	200	200	..	..
12a	..	..	..	550	..	200	150	..	200	200	..	..
12b	..	..	..	550	..	200	150	..	200	200	..	..
13a	..	..	300	..	..	200	150	..	200	200	..	..
13b	..	..	300	..	..	200	150	..	200	200	..	..
14a	..	..	..	..	420	200	150	..	200	200	..	..
14b	..	..	..	..	420	200	150	..	200	200	..	..
15a	..	..	300	200	100	200	..	200	400	..	..	..
15b	..	..	300	200	100	200	..	200	300	..	..	500
16a	..	336 <sup>4</sup>	300	200	100	200	150	..	400	400	..	..
16b	..	..	300	200	100	200	150	..	400	400	..	..
5 { 17a	..	..	..	..	..	..	..	..	200	200	..	..
17b	..	..	..	..	..	..	..	..	200	200	..	..
5 { 18a	..	..	300	200	100	200	150	..	..	..	..	..
18b	..	..	300	200	100	200	150	..	..	..	..	..
19	..	..	..	..	..	200	..	200	300	..	..	500
20	Unmanured		..	..	..	..	..	..	..	..	..	..
21	..	..	300	200	100	..	..	..	..	100	..	..
22	..	..	300	200	100	..	..	..	100	..	..	..

\* For the particulars of the produce of each separate season, see Tables X.-XXI. inclusive; and for those of the twelve years collectively, Tables XXII.-XXVI. inclusive.

## NOTES TO TABLE IX. (p. 162.)

[TABLE IX. is intended to be drawn out to the left, free of the book, as it has reference to the succeeding Tables.]

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<sup>1</sup> *For the 16th and succeeding seasons*—the sulphate of potass was reduced from 600 to 400 lbs. per acre per annum on Plot 1, and from 300 to 200 lbs. on all the other Plots where it was used; the sulphate of soda from 400 to 200 lbs. on Plot 1, to 100 lbs. on all the Plots on which 200 lbs. had previously been applied, and from 550 to 336½ lbs. (two-thirds the amount) on Plots 12*a* and 12*b*; and the sulphate of magnesia from 420 to 280 lbs. (two-thirds the amount) on Plots 14*a* and 14*b*.

<sup>2</sup> *Plot 9a*—the sulphates of potass, soda, and magnesia, and the superphosphate of lime, were applied in the 12th and succeeding seasons, but not in the 9th, 10th, and 11th; and the amount of nitrate of soda was for the 9th season only 475 lbs. per acre, and for the 10th and 11th seasons only 275 lbs.

<sup>3</sup> *Plot 9b*—in the 9th season only 475 lbs. of nitrate of soda were applied.

<sup>4</sup> *Common salt*—not applied after the 10th season.

<sup>5</sup> *Plots 17a and 17b, and 18a and 18b*—the manures on these plots alternate: that is, Plots 17 were manured with ammonia-salts in the 9th season; with the sulphates of potass, soda, and magnesia, and superphosphate of lime, in the 10th; ammonia-salts again in the 11th; the sulphates of potass, soda, and magnesia, and superphosphate of lime, again in the 12th, and so on. Plots 18, on the other hand, had the sulphates of potass, soda, and magnesia, and superphosphate of lime, in the 9th season; ammonia-salts in the 10th, and so on, alternately.

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE X.—PRODUCE of the 9TH SEASON, 1851-2. SEED (Red Cluster)  
sown November 7, 1851; Crop cut August 24, 1852.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.			Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.			Total Produce.
	Quantity.	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	15	0 $\frac{3}{4}$	55.8	72	919	1706	2625	59	109	168	8.4	53.8
1	13	1	56.9	71 $\frac{1}{4}$	825	1497	2322	— 35	— 100	— 135	9.4	55.1
2	27	2 $\frac{1}{4}$	58.2	112 $\frac{1}{2}$	1716	3457	5173	856	1860	2716	7.0	49.6
3	13	3 $\frac{3}{4}$	56.6	78	860	1597	2457	..	..	..	9.9	53.9
4	13	1 $\frac{1}{4}$	57.3	106 $\frac{1}{4}$	870	1571	2441	10	— 26	— 16	13.9	55.4
5a	16	3	57.5	72 $\frac{1}{2}$	1038	1903	2941	178	306	484	7.5	54.5
5b	17	0 $\frac{1}{4}$	57.3	86 $\frac{1}{4}$	1065	2032	3097	205	435	640	8.8	52.4
6a	20	3	57.6	95 $\frac{3}{4}$	1288	2581	3869	428	984	1412	8.0	49.9
6b	20	3 $\frac{1}{2}$	57.5	101 $\frac{3}{4}$	1300	2604	3904	440	1007	1447	8.5	49.9
7a	26	2 $\frac{1}{2}$	56.0	126 $\frac{3}{4}$	1615	3850	5465	755	2253	3008	8.5	41.9
7b	26	3 $\frac{3}{4}$	55.8	139 $\frac{1}{4}$	1643	3772	5415	783	2175	2958	9.2	43.6
8a	27	3 $\frac{1}{2}$	55.9	140 $\frac{1}{2}$	1699	3806	5505	839	2209	3048	9.0	44.6
8b	27	0 $\frac{1}{2}$	55.9	133 $\frac{1}{2}$	1651	3772	5423	791	2175	2966	8.8	43.8
9a	25	2	55.6	171 $\frac{3}{4}$	1591	3714	5305	731	2117	2848	12.1	42.8
9b	24	1 $\frac{3}{4}$	55.3	153	1509	3374	4883	649	1777	2426	11.3	44.7
10a	21	3 $\frac{1}{2}$	55.9	97 $\frac{1}{2}$	1320	2787	4107	460	1190	1650	8.0	47.3
10b	22	0 $\frac{1}{4}$	57.3	80	1343	2819	4162	483	1222	1705	6.3	47.6
11a	24	0 $\frac{3}{4}$	55.6	128	1472	3081	4553	612	1484	2096	9.5	47.8
11b	22	1 $\frac{1}{2}$	55.9	133 $\frac{1}{4}$	1387	2912	4299	527	1315	1842	10.6	47.6
12a	24	1 $\frac{3}{4}$	57.4	100 $\frac{3}{4}$	1503	3257	4760	643	1660	2303	7.2	46.1
12b	24	1 $\frac{1}{4}$	57.3	101 $\frac{3}{4}$	1492	3232	4724	632	1635	2267	7.3	46.2
13a	24	0	57.5	100 $\frac{3}{4}$	1480	3222	4702	620	1625	2245	7.3	45.9
13b	23	3 $\frac{3}{4}$	57.1	106 $\frac{3}{4}$	1476	3289	4765	616	1692	2308	7.8	44.9
14a	24	1 $\frac{3}{4}$	56.9	114 $\frac{1}{4}$	1507	3547	5054	647	1950	2597	8.2	42.5
14b	25	0 $\frac{1}{4}$	56.7	107	1530	3607	5137	670	2010	2680	7.5	42.4
15a	23	1 $\frac{1}{2}$	57.4	111 $\frac{3}{4}$	1451	3212	4663	591	1615	2206	8.3	45.2
15b	25	0 $\frac{1}{2}$	56.8	90 $\frac{3}{4}$	1520	3421	4941	660	1824	2484	6.3	44.4
16a	28	3 $\frac{1}{2}$	55.0	204 $\frac{1}{4}$	1794	4677	6471	934	3080	4014	12.8	38.3
16b	28	0	54.5	175	1700	4616	6316	840	3019	3859	11.5	36.8
17a	25	2	56.5	135 $\frac{1}{2}$	1577	3734	5311	717	2137	2854	9.4	42.2
17b	24	1 $\frac{1}{2}$	56.9	132	1520	3466	4986	660	1869	2529	9.5	43.9
18a	13	3	57.0	86 $\frac{1}{4}$	869	1687	2556	9	90	99	11.0	51.5
18b	14	3 $\frac{3}{4}$	56.7	75	921	1764	2685	61	167	228	8.9	52.2
19	24	3 $\frac{3}{4}$	56.1	183 $\frac{1}{4}$	1582	3397	4979	722	1800	2522	13.1	46.6
20	14	0 $\frac{3}{4}$	56.6	71	875	1577	2452	15	— 20	— 5	8.8	55.5
21	19	1 $\frac{3}{4}$	56.9	68 $\frac{1}{4}$	1177	2108	3285	317	511	828	6.2	55.8
22	19	2 $\frac{1}{4}$	55.9	82 $\frac{1}{2}$	1176	2179	3355	316	582	898	7.5	53.9



EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XI.—PRODUCE of the 10TH SEASON, 1853. SEED (Red Rostock)  
sown March 16; Crop cut September 10, and carted September 20, 1853.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).							INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.			Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.										
	Bush.	Pks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	9	0 $\frac{3}{4}$	49.1	142 $\frac{1}{2}$	599	1807	2406	240	394	634	31.1	33.1
1	6	1 $\frac{3}{4}$	46.1	100 $\frac{3}{4}$	404	1632	2036	45	219	264	33.2	24.8
2	19	0 $\frac{1}{2}$	51.1	143	1120	3372	4492	761	1959	2720	14.6	33.2
3	5	3 $\frac{1}{4}$	45.1	93	359	1413	1772	..	..	..	35.0	25.4
4	7	1	46.1	107	446	1670	2116	87	257	344	31.6	20.3
5a	10	0	48.9	99 $\frac{3}{4}$	587	1951	2538	228	538	766	20.5	30.1
5b	10	1	48.9	111 $\frac{1}{2}$	611	2130	2741	252	717	969	22.6	28.7
6a	16	3 $\frac{1}{2}$	51.8	112 $\frac{3}{4}$	978	2777	3755	619	1364	1983	13.0	35.2
6b	19	1	51.8	80 $\frac{1}{2}$	1072	2798	3870	713	1385	2098	8.1	38.3
7a	23	2 $\frac{1}{2}$	52.2	139	1369	3741	5110	1010	2328	3338	11.3	36.6
7b	23	2 $\frac{1}{4}$	51.1	132 $\frac{1}{2}$	1357	3734	5091	998	2321	3319	10.8	36.3
8a	22	1 $\frac{1}{2}$	51.1	191 $\frac{3}{4}$	1346	3966	5312	987	2553	3540	16.6	33.9
8b	24	2 $\frac{1}{4}$	51.1	150 $\frac{3}{4}$	1425	3927	5352	1066	2514	3580	11.8	36.3
9a	11	1	47.7	155 $\frac{1}{2}$	691	2399	3090	332	986	1318	29.0	28.8
9b	10	1 $\frac{3}{4}$	46.1	158 $\frac{1}{4}$	649	2253	2902	290	840	1130	32.2	28.8
10a	9	3 $\frac{3}{4}$	48.9	159 $\frac{3}{4}$	642	2049	2691	283	636	919	33.1	31.3
10b	15	2	49.8	127 $\frac{1}{2}$	896	2682	3578	537	1269	1806	16.6	33.4
11a	17	2	50.1	127 $\frac{3}{4}$	1015	2524	3539	656	1111	1767	14.4	40.2
11b	18	2 $\frac{3}{4}$	51.1	117	1073	2707	3780	714	1294	2008	12.3	39.7
12a	22	0	52.0	137 $\frac{3}{4}$	1283	3665	4948	924	2252	3176	12.0	35.0
12b	23	3 $\frac{1}{2}$	51.1	140 $\frac{1}{2}$	1375	3704	5079	1016	2291	3307	11.4	37.1
13a	22	1 $\frac{1}{4}$	52.1	179	1341	3704	5045	982	2291	3273	15.4	36.2
13b	23	2 $\frac{1}{2}$	51.1	169	1396	3912	5308	1037	2499	3536	13.8	35.7
14a	21	2	51.2	203 $\frac{1}{4}$	1322	3471	4793	963	2058	3021	18.2	38.1
14b	23	0 $\frac{3}{4}$	52.6	132 $\frac{3}{4}$	1347	3761	5108	988	2348	3336	10.9	35.8
15a	19	0	51.1	161 $\frac{3}{4}$	1143	3361	4504	784	1948	2732	16.5	34.0
15b	23	2 $\frac{1}{2}$	51.1	130 $\frac{1}{2}$	1351	3756	5107	992	2343	3335	10.7	36.0
16a	24	1 $\frac{1}{2}$	52.5	220	1496	4904	6400	1137	3491	4628	17.2	30.5
16b	25	3 $\frac{1}{4}$	52.5	186 $\frac{3}{4}$	1537	5019	6556	1178	3606	4784	13.8	30.6
17a	8	1 $\frac{3}{4}$	49.8	101 $\frac{3}{4}$	520	1996	2516	161	583	744	24.3	26.1
17b	8	3 $\frac{3}{4}$	48.9	102 $\frac{1}{2}$	539	2012	2551	180	599	779	23.5	26.8
18a	17	3 $\frac{1}{4}$	52.9	175	1111	3385	4496	752	1972	2724	18.7	32.8
18b	20	3	52.1	163 $\frac{3}{4}$	1256	3796	5052	897	2383	3280	15.0	33.1
19	19	1 $\frac{1}{4}$	52.6	147 $\frac{1}{2}$	1160	3213	4373	801	1800	2601	14.6	36.1
20	5	3 $\frac{1}{4}$	47.8	150	425	1659	2084	66	246	312	54.4	25.6
21	12	3 $\frac{3}{4}$	50.4	101 $\frac{3}{4}$	753	2181	2934	394	768	1162	15.6	34.5
22	10	1	49.4	86	592	1860	2452	233	447	680	17.0	31.8

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XII.—PRODUCE of the 11TH SEASON, 1853-4. SEED (Red Rostock)  
sown November 12, 1853; Crop cut August 21, and carted August 31, 1854.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).							INCREASE PER ACRE PER MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.			Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.										
	Bush.	Pks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	26	1 $\frac{3}{4}$	61.0	59 $\frac{3}{4}$	1672	2114	3786	313	— 23	290	3.7	79.1
1	24	1 $\frac{1}{2}$	60.2	59 $\frac{1}{4}$	1529	2531	4060	170	394	564	4.0	60.4
2	41	0 $\frac{1}{2}$	62.5	103 $\frac{1}{4}$	2675	4450	7125	1316	2313	3629	4.0	60.1
3	21	0 $\frac{1}{4}$	60.6	82	1359	2137	3496	..	..	..	6.4	63.6
4	23	3 $\frac{1}{2}$	61.1	61 $\frac{3}{4}$	1521	2338	3859	162	201	363	4.2	65.1
5a	24	1 $\frac{1}{2}$	61.0	91 $\frac{1}{4}$	1578	2520	4098	219	383	602	6.1	62.6
5b	24	0	61.6	53	1532	2503	4035	173	366	539	3.6	61.2
6a	33	2 $\frac{3}{4}$	61.8	103 $\frac{1}{4}$	2186	3845	6031	827	1708	2535	5.0	56.8
6b	34	2 $\frac{1}{4}$	61.8	100 $\frac{1}{2}$	2239	4055	6294	880	1918	2798	4.7	55.2
7a	45	2 $\frac{1}{4}$	61.9	131 $\frac{1}{2}$	2950	5603	8553	1591	3466	5057	4.7	52.6
7b	45	1 $\frac{1}{2}$	61.8	14 $\frac{1}{4}$	2944	5496	8440	1585	3359	4944	5.0	53.6
8a	47	1 $\frac{3}{4}$	61.4	152 $\frac{3}{4}$	3065	6135	9200	1706	3998	5704	5.3	50.0
8b	49	2 $\frac{1}{2}$	61.8	139 $\frac{1}{2}$	3208	6117	9325	1849	3980	5829	4.6	52.4
9a	38	3	60.7	103 $\frac{1}{2}$	2456	4142	6598	1097	2005	3102	4.4	59.3
9b	38	3 $\frac{1}{2}$	60.7	118 $\frac{1}{4}$	2480	4243	6723	1121	2106	3227	5.0	58.4
10a	34	1 $\frac{1}{2}$	60.5	13 $\frac{1}{2}$	2211	3597	5808	852	1460	2312	6.3	61.5
10b	39	0 $\frac{3}{4}$	61.6	121 $\frac{1}{4}$	2535	4468	7003	1176	2331	3507	5.0	56.7
11a	44	2	61.1	140 $\frac{1}{4}$	2859	5147	8006	1500	3010	4510	5.2	55.6
11b	43	0 $\frac{1}{2}$	61.2	117 $\frac{1}{2}$	2756	5020	7776	1397	2883	4280	4.5	54.9
12a	45	3 $\frac{1}{4}$	62.2	114 $\frac{1}{4}$	2966	5503	8469	1607	3366	4973	4.0	53.9
12b	45	1 $\frac{1}{2}$	62.2	115	2939	5473	8412	1580	3336	4916	4.1	53.7
13a	45	0 $\frac{1}{2}$	62.2	106	2913	5398	8311	1554	3261	4815	3.8	54.0
13b	43	3 $\frac{1}{2}$	62.2	130 $\frac{1}{4}$	2858	5545	8403	1499	3408	4907	4.8	51.6
14a	45	1 $\frac{1}{4}$	62.2	127 $\frac{3}{4}$	2946	5552	8498	1587	3415	5002	4.5	53.1
14b	44	0 $\frac{1}{2}$	62.2	120 $\frac{1}{4}$	2863	5418	8281	1504	3281	4785	4.4	52.9
15a	43	1 $\frac{1}{2}$	62.1	111 $\frac{1}{4}$	2801	4898	7699	1442	2761	4203	4.1	57.2
15b	43	1	62.4	112 $\frac{1}{2}$	2810	5273	8083	1451	3136	4587	4.2	53.3
16a	49	2 $\frac{1}{2}$	61.7	173 $\frac{1}{4}$	3230	6702	9932	1971	4565	6536	5.7	48.2
16b	50	0 $\frac{3}{4}$	61.7	190	3293	6635	9928	1934	4498	6432	6.3	49.6
17a	45	3	62.1	104	2948	5270	8218	1589	3133	4722	3.7	55.9
17b	42	2 $\frac{1}{4}$	62.2	86 $\frac{1}{2}$	2732	4897	7629	1373	2760	4133	3.3	55.8
18a	24	0	61.2	55	1526	2418	3944	167	281	448	3.8	63.1
18b	23	2 $\frac{3}{4}$	61.0	64 $\frac{1}{2}$	1511	2377	3888	152	240	392	4.5	63.6
19	41	0 $\frac{3}{4}$	61.7	12 $\frac{1}{2}$	2666	4677	7343	1307	2540	3847	4.8	57.0
20	22	3	60.8	62	1445	2217	3662	86	80	166	4.5	65.2
21	32	0 $\frac{1}{2}$	61.2	63	2030	3440	5470	671	1303	1974	3.3	59.1
22	31	3	61.0	55 $\frac{1}{2}$	1994	3340	5334	635	1203	1838	2.9	59.7

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XIII.—PRODUCE of the 12TH SEASON, 1854-5. SEED (Red Rostock)  
sown November 9, 1854; Crop cut August 26, and carted September 2, 1855.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw)	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.									
	Bush. Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	17 0	60·7	63	1096	1726	2822	24	— 61	— 37	6·1	63·5
1	18 2	60·5	57½	1179	1890	3069	107	103	210	5·1	62·4
2	34 2½	62·0	88½	2237	3845	6082	1165	2058	3223	4·1	58·2
3	17 0	59·2	65¾	1072	1787	2859	..	..	..	6·5	60·0
4	18 2½	59·5	57½	1168	1832	3000	96	45	141	5·2	63·8
5a	18 2	59·9	46½	1157	1819	2976	85	32	117	4·2	63·6
5b	18 0½	60·1	51½	1143	1800	2943	71	13	84	4·7	63·5
6a	27 3	60·3	80¾	1753	2837	4590	681	1050	1731	4·8	61·8
6b	28 1	60·9	87¾	1811	3037	4848	739	1250	1989	5·1	59·6
7a	32 2¾	59·4	142	2084	3911	5995	1012	2124	3136	7·3	53·3
7b	33 1¼	59·5	154	2138	4158	6296	1066	2371	3437	7·8	51·4
8a	29 3	58·8	160	1909	3838	5747	837	2051	2888	9·2	49·7
8b	33 0¾	58·7	205	2153	4342	6495	1081	2555	3636	10·5	49·6
9a	29 2½	58·3	203¾	1932	3946	5878	860	2159	3019	11·8	49·0
9b	25 1½	57·3	152½	1605	3212	4817	533	1425	1958	10·5	50·0
10a	19 3¾	57·1	145	1285	2512	3797	213	725	938	12·7	51·2
10b	28 0½	58·9	145	1805	3268	5073	733	1481	2214	8·7	55·2
11a	18 3	55·3	174	1210	2484	3694	138	697	835	16·8	48·7
11b	24 2½	56·3	193¾	1580	3153	4733	508	1366	1874	14·0	50·1
12a	30 0¼	59·5	151½	1940	3538	5478	868	1751	2619	8·5	54·8
12b	33 2	60·2	157	2172	4010	6182	1100	2223	3323	7·8	54·2
13a	29 0	59·9	187¾	1924	3503	5427	852	1716	2568	10·8	54·9
13b	32 2	60·4	147¾	2110	3870	5980	1038	2083	3121	7·5	54·5
14a	29 3	60·0	167¾	1954	3577	5531	882	1790	2672	9·4	54·6
14b	33 1¾	60·0	148¾	2158	4003	6161	1086	2216	3302	7·4	53·9
15a	31 3¼	60·0	119½	2030	3825	5855	958	2038	2996	6·3	53·1
15b	33 3	60·6	146½	2193	4222	6415	1121	2435	3556	7·2	52·0
16a	33 1¼	58·2	160	2100	4534	6634	1028	2747	3775	8·3	46·3
16b	32 2	58·2	225¾	2115	4991	7106	1043	3204	4247	12·0	42·4
17a	18 3¾	60·8	78½	1227	1976	3203	155	189	344	6·8	62·1
17b	17 0½	60·3	77¾	1110	1804	2914	38	17	55	7·5	61·5
18a	32 3¾	60·9	122¾	2127	4017	6144	1055	2230	3285	6·1	52·9
18b	33 1¾	60·8	135¾	2170	4215	6385	1098	2428	3526	6·7	51·5
19	30 0½	58·7	195¾	1967	3851	5818	895	2064	2959	11·1	51·1
20	17 2½	61·1	76½	1155	1831	2986	83	44	127	7·1	63·1
21	24 1¾	60·8	47	1533	2419	3952	461	632	1093	3·2	63·4
22	24 2½	60·1	70¾	1553	2457	4010	481	670	1151	4·8	63·2

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XIV.—PRODUCE of the 13TH SEASON, 1855-6. SEED (Red Rostock)  
sown November 13, 1855; Crop cut August 26, and carted September 3, 1856.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity.	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
0	18	1½	56·8	132½	1179	1969	3148	287	411	698	12·7	59·9
1	17	0¾	56·3	135½	1102	1933	3035	210	375	585	14·0	57·0
2	36	1¼	58·6	150	2277	4317	6594	1385	2759	4144	7·1	52·8
3	14	2	54·3	103¼	892	1558	2450	..	..	..	13·1	57·3
4	16	1½	55·5	115¾	1026	1731	2757	134	173	307	12·7	59·3
5a	18	3¼	56·5	104¾	1167	2012	3179	275	454	729	9·9	58·0
5b	20	1¼	56·2	106¼	1247	2122	3369	355	564	919	9·4	58·7
6a	27	1¼	58·2	128¼	1717	3050	4767	825	1492	2317	8·1	56·3
6b	28	0½	58·5	110¾	1755	3093	4848	863	1535	2398	6·7	56·7
7a	37	1	58·0	152½	2312	4560	6872	1420	3002	4422	7·1	50·7
7b	36	2¼	57·6	140¾	2244	4398	6642	1352	2840	4192	6·7	51·0
8a	40	0½	56·8	228½	2507	5182	7689	1615	3624	5239	10·0	48·4
8b	37	3¼	57·1	230¾	2400	5089	7489	1508	3531	5039	10·6	47·2
9a	32	1½	57·2	168¼	2019	3875	5894	1127	2317	3444	9·1	52·1
9b	26	0	56·3	214¼	1679	3152	4831	787	1594	2381	14·6	53·3
10a	24	0¾	55·6	162½	1505	2818	4323	613	1260	1873	12·1	53·4
10b	27	2¾	57·2	145	1727	3168	4895	835	1610	2445	9·2	54·5
11a	31	3½	57·3	173¼	2001	3517	5518	1109	1959	3068	9·5	56·9
11b	30	2½	57·5	183¾	1946	3443	5389	1054	1885	2939	10·4	56·5
12a	33	3¾	58·7	111¾	2102	3847	5949	1210	2289	3499	5·6	54·7
12b	32	3½	58·8	145¾	2079	3725	5804	1187	2167	3354	7·5	55·8
13a	32	1¾	58·6	138	2036	3743	5779	1144	2185	3329	7·3	54·4
13b	30	3¼	58·9	193	2008	3651	5659	1116	2093	3209	10·6	55·0
14a	35	0¼	58·6	140½	2195	4202	6397	1303	2644	3947	6·9	52·2
14b	34	0¾	59·0	145	2162	4117	6279	1270	2559	3829	7·2	52·5
15a	30	0½	59·1	142½	1923	3521	5444	1031	1963	2994	8·0	54·6
15b	32	0	59·4	143¼	2045	3752	5797	1153	2194	3347	7·5	54·5
16a	38	0½	58·5	195¾	2426	5529	7955	1534	3971	5505	8·8	43·9
16b	37	3	58·7	232½	2450	5467	7917	1558	3909	5467	10·5	44·8
17a	31	2½	59·0	116¾	1983	3558	5541	1091	2000	3091	6·3	55·7
17b	30	1½	59·1	137½	1935	3465	5400	1043	1907	2950	7·7	55·9
18a	17	3½	57·8	107	1140	2012	3152	248	454	702	10·4	56·7
18b	18	0	57·7	93¼	1131	1938	3069	239	380	619	9·0	58·3
19	32	1	58·9	157½	2059	3562	5621	1167	2004	3171	8·3	57·8
20	17	0¾	57·7	83½	1075	1888	2963	183	330	513	8·4	57·0
21	22	1½	58·0	98	1398	2529	3927	506	971	1477	7·5	55·3
22	21	1¾	57·8	109¼	1351	2498	3849	459	940	1399	8·8	54·1



EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XV.—PRODUCE of the 14TH SEASON, 1856-7. SEED (Red Rostock)  
sown November 6, 1856; Crop cut August 13, and carted August 22, 1857.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).							INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.			Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.		Weight per Bushel.									
	Bush.	Pecks.										
0	18	2½	59.0	86½	1181	1545	2726	- 55	- 32	- 87	7.9	76.5
1	17	2½	59.0	76	1118	1532	2650	- 118	- 45	- 163	7.3	73.0
2	41	0½	60.4	98½	2587	3323	5910	1351	1746	3097	4.0	77.9
3	19	3½	58.3	74½	1236	1577	2813	..	..	..	6.4	78.3
4	22	1½	58.8	67½	1386	1572	2958	150	- 5	145	5.1	88.2
5a	22	3½	59.0	56½	1409	1617	3026	173	40	213	4.2	87.2
5b	24	2½	58.8	66½	1512	1735	3247	276	158	434	4.6	87.1
6a	35	1½	59.9	92½	2211	2757	4968	975	1180	2155	4.4	80.2
6b	35	1½	59.8	78½	2193	2757	4950	957	1180	2137	3.7	79.6
7a	43	1½	60.5	160½	2782	3680	6462	1546	2103	3649	6.1	75.6
7b	46	1½	60.3	108½	2902	3891	6793	1666	2314	3980	3.9	74.6
8a	47	3	60.8	158½	3058	4297	7355	1822	2720	4542	5.5	71.2
8b	48	3½	60.6	169½	3129	4450	7579	1893	2873	4766	5.7	70.3
9a	43	3	60.1	135	2767	3867	6634	1531	2290	3821	5.1	71.6
9b	36	0½	58.0	121½	2220	2983	5203	984	1406	2390	5.8	74.4
10a	29	0½	58.0	125½	1816	2392	4208	580	815	1395	7.4	75.9
10b	34	2	58.6	163½	2185	2875	5060	949	1298	2247	8.1	76.0
11a	39	0	58.5	150	2432	2943	5375	1196	1366	2562	6.6	82.6
11b	39	0	58.0	121½	2397	2920	5317	1161	1343	2504	5.4	82.1
12a	43	3½	60.4	100	2747	3647	6394	1511	2070	3581	3.8	75.3
12b	43	2	60.4	104½	2729	3583	6312	1493	2006	3499	4.0	76.2
13a	42	3	60.6	122½	2714	3707	6421	1478	2130	3608	4.7	73.2
13b	43	2	60.5	108½	2739	3647	6386	1503	2070	3573	4.1	75.1
14a	43	3	60.5	134½	2781	3658	6439	1545	2081	3626	5.1	76.0
14b	42	3½	60.3	113½	2699	3652	6351	1463	2075	3538	4.4	73.9
15a	42	1½	60.4	125½	2681	3687	6368	1445	2110	3555	4.9	72.7
15b	44	1½	60.0	96½	2765	3778	6543	1529	2201	3730	3.6	73.2
16a	48	3½	60.5	175	3131	4683	7814	1895	3106	5001	5.9	66.9
16b	50	0	60.5	169½	3194	4703	7897	1958	3126	5084	5.6	67.9
17a	26	2½	59.1	66½	1642	2058	3700	406	481	887	4.2	79.8
17b	25	3½	58.8	59½	1583	1940	3523	347	363	710	3.9	81.6
18a	41	0½	59.7	114½	2566	3443	6009	1330	1866	3196	4.7	74.5
18b	40	0½	59.8	124½	2519	3365	5884	1283	1788	3071	5.2	74.9
19	41	2½	59.5	123½	2600	3193	5793	1364	1616	2980	5.0	81.4
20	19	2½	58.4	62½	1213	1564	2777	- 23	- 13	- 36	5.5	77.6
21	24	0	60.6	81½	1538	1815	3353	302	238	540	5.6	84.8
22	23	0½	60.6	87½	1491	1807	3298	255	230	485	6.2	82.5

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XVI.—PRODUCE of the 15TH SEASON, 1857-8. SEED (Red Rostock)  
sown November 3 and 11, 1857; Crop cut August 9, and carted August 20, 1858.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity.	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
0	20	3	61.2	61 $\frac{1}{4}$	1332	1902	3234	191	232	423	4.8	70.0
1	16	1 $\frac{1}{4}$	60.7	64 $\frac{1}{2}$	1055	1630	2685	86	40	126	6.5	64.7
2	38	3 $\frac{1}{4}$	62.6	82 $\frac{1}{2}$	2512	3837	6349	1371	2167	3538	3.4	65.5
3	18	0	60.4	52	1141	1670	2811	..	..	..	4.8	68.3
4	19	0 $\frac{1}{2}$	61.1	36 $\frac{3}{4}$	1206	1673	2879	65	3	68	3.1	72.1
5a	18	2 $\frac{3}{4}$	61.5	35	1187	1532	2719	46	138	92	3.0	77.5
5b	19	1	61.4	45	1227	1643	2870	86	27	59	3.8	74.7
6a	28	2 $\frac{1}{4}$	62.1	41 $\frac{3}{4}$	1818	2577	4395	677	907	1584	2.3	70.6
6b	29	0 $\frac{1}{2}$	62.1	38 $\frac{1}{2}$	1850	2713	4563	709	1043	1752	2.1	68.2
7a	38	2 $\frac{1}{4}$	61.9	65	2450	3965	6415	1309	2295	3604	2.7	61.8
7b	39	2 $\frac{1}{4}$	62.3	68	2530	4092	6622	1389	2422	3811	2.8	61.8
8a	41	3 $\frac{3}{4}$	61.8	86 $\frac{3}{4}$	2680	4667	7347	1539	2997	4536	3.3	57.4
8b	41	3 $\frac{1}{4}$	61.7	94 $\frac{1}{2}$	2675	4667	7342	1534	2997	4531	3.7	57.3
9a	37	2 $\frac{1}{4}$	60.8	100	2384	4317	6701	1243	2647	3890	4.4	55.2
9b	23	2	58.8	88	1470	2688	4158	329	1018	1347	6.4	54.7
10a	22	3 $\frac{1}{2}$	59.6	75 $\frac{3}{4}$	1439	2130	3569	298	460	758	5.6	67.6
10b	27	3	61.4	70 $\frac{3}{4}$	1775	2615	4390	634	945	1579	4.1	67.9
11a	30	3 $\frac{1}{2}$	60.5	108 $\frac{3}{4}$	1977	2797	4774	836	1127	1963	5.8	70.7
11b	33	0 $\frac{1}{4}$	60.4	104	2099	3018	5117	958	1348	2306	5.2	69.6
12a	37	3 $\frac{3}{4}$	62.1	78 $\frac{3}{4}$	2437	3663	6100	1296	1993	3289	3.3	66.5
12b	37	0 $\frac{3}{4}$	62.1	76 $\frac{1}{2}$	2387	3673	6060	1246	2003	3249	3.3	65.0
13a	37	0 $\frac{3}{4}$	62.1	72	2384	3693	6077	1243	2023	3266	3.1	64.6
13b	37	0 $\frac{3}{4}$	62.7	66 $\frac{3}{4}$	2397	3677	6074	1256	2007	3263	2.9	65.2
14a	37	3 $\frac{1}{4}$	62.1	65 $\frac{3}{4}$	2413	3737	6150	1272	2067	3339	2.8	64.6
14b	38	1 $\frac{1}{4}$	62.0	61 $\frac{1}{2}$	2436	3710	6146	1295	2040	3335	2.6	65.8
15a	35	1 $\frac{1}{2}$	62.6	70 $\frac{3}{4}$	2285	3515	5800	1144	1845	2989	3.2	65.0
15b	37	2	62.8	81 $\frac{1}{2}$	2436	3698	6134	1295	2028	3323	3.5	65.9
16a	41	3	62.1	106 $\frac{3}{4}$	2702	4797	7499	1561	3127	4688	4.1	56.3
16b	42	0 $\frac{1}{2}$	62.1	99 $\frac{1}{2}$	2717	4813	7530	1576	3143	4719	3.8	56.5
17a	33	1 $\frac{1}{4}$	62.5	66 $\frac{3}{4}$	2150	3203	5353	1009	1533	2542	3.2	67.1
17b	33	3 $\frac{1}{4}$	62.5	65 $\frac{3}{4}$	2181	3274	5455	1040	1604	2644	3.1	66.6
18a	22	3 $\frac{1}{4}$	62.3	41 $\frac{3}{4}$	1472	2006	3480	331	338	669	2.9	73.3
18b	20	2 $\frac{3}{4}$	62.4	49 $\frac{1}{4}$	1338	1967	3305	197	297	494	3.8	68.0
19	33	1 $\frac{1}{4}$	62.5	93 $\frac{1}{2}$	2177	3185	5362	1036	1515	2551	4.5	68.3
20	17	0	60.3	63 $\frac{1}{2}$	1089	1730	2819	52	60	8	6.2	63.0
21	24	1 $\frac{3}{4}$	61.5	70 $\frac{1}{4}$	1574	2373	3947	433	703	1136	4.8	66.3
22	22	0	61.5	58 $\frac{1}{4}$	1412	2180	3592	271	510	781	4.3	64.8

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XVII.—PRODUCE OF THE 16TH SEASON, 1858-9. SEED (Red Ros-  
tock) sown November 4, 1858; Crop cut August 4, and carted August 20, 1859.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.									
	Bush. Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	21 2½	54.0	88½	1254	2310	3564	203	135	338	7.6	54.3
1	19 3	55.0	101	1189	2300	3489	138	125	263	9.3	51.7
2	36 0¾	56.5	218½	2263	4810	7073	1212	2635	3847	10.7	47.1
3	18 1¼	52.5	88½	1051	2175	3226	..	..	..	9.2	48.3
4	19 0¾	55.0	131½	1188	2230	3418	137	55	192	12.5	53.3
5a	20 2½	56.0	123½	1277	2323	3600	226	148	374	10.7	55.0
5b	20 2½	56.0	118½	1273	2393	3666	222	218	440	10.2	53.2
6a	29 2½	56.5	133½	1808	3747	5555	757	1572	2329	8.0	48.3
6b	30 0½	56.5	153½	1855	3853	5708	804	1678	2482	9.0	48.1
7a	34 2½	55.9	158½	2097	4677	6774	1046	2502	3548	8.2	44.9
7b	34 2½	55.9	155	2089	4803	6892	1038	2628	3666	8.0	43.5
8a	34 3¼	54.0	186½	2068	5353	7421	1017	3178	4195	9.9	38.6
8b	34 0¾	53.4	181½	2007	5597	7604	956	3422	4378	10.0	35.9
9a	30 0	54.5	170½	1806	5270	7076	755	3095	3850	10.5	34.3
9b	24 2¼	50.5	170	1412	3590	5002	361	1415	1776	13.7	39.3
10a	18 3¾	51.5	230	1207	2730	3937	156	555	711	23.5	44.2
10b	25 2	52.5	160	1500	3420	4920	449	1245	1694	11.9	43.9
11a	26 3½	51.4	248½	1628	3527	5155	577	1352	1929	18.0	46.2
11b	27 3¼	51.3	274½	1698	3577	5275	647	1402	2049	19.3	47.5
12a	34 2½	54.5	170½	2060	4550	6610	1009	2375	3384	9.0	45.3
12b	34 3½	54.8	206½	2115	4743	6858	1064	2568	3632	10.9	44.6
13a	34 0¾	55.0	155½	2037	4737	6774	986	2562	3548	8.3	43.0
13b	34 3½	55.0	168½	2087	4807	6894	1036	2632	3668	8.8	43.4
14a	34 1¾	54.5	175½	2054	4763	6817	1003	2588	3591	9.4	43.1
14b	34 2¼	54.5	188½	2074	4700	6774	1023	2525	3548	10.0	44.1
15a	34 0¾	55.0	171½	2053	4773	6826	1002	2598	3600	9.1	43.0
15b	35 0¼	55.0	165	2095	4993	7088	1044	2818	3862	8.6	42.0
16a	34 3¾	52.6	189½	2026	5927	7953	975	3752	4727	10.3	34.2
16b	34 1¾	52.6	193	2005	5793	7798	954	3618	4572	10.7	34.6
17a	21 1¼	55.0	73½	1247	2483	3730	196	308	504	6.3	50.2
17b	19 3	54.5	90	1168	2373	3541	117	198	315	8.3	49.2
18a	32 3¼	55.5	153½	1973	4533	6506	922	2358	3280	8.4	43.5
18b	32 2	56.0	158½	1980	4650	6630	929	2475	3404	8.7	42.6
19	30 2	55.5	211½	1903	4023	5926	852	1848	2700	12.5	47.3
20	17 3¼	52.5	102½	1039	2217	3256	12	42	30	11.0	46.9
21	26 1½	54.0	115½	1538	3185	4723	487	1010	1497	8.1	48.3
22	24 0¾	55.0	130	1460	2980	4440	409	805	1214	9.8	49.0

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XVIII.—PRODUCE of the 17TH SEASON, 1859-60. SEED (Red Rostock) sown November 17, 1859; Crop cut September 17 and 19, and carted October 5, 1860.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity.	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
0	14	1 $\frac{3}{4}$	53·5	61 $\frac{1}{4}$	826	1445	2271	88	— 14	74	8·0	57·2
1	12	1 $\frac{3}{4}$	52·8	61	717	1380	2097	— 21	— 79	— 100	9·3	52·0
2	32	1 $\frac{3}{4}$	55·5	72 $\frac{1}{2}$	1864	3440	5304	1126	1981	3107	4·1	54·2
3	12	3 $\frac{1}{2}$	52·6	62 $\frac{1}{2}$	738	1459	2197	..	..	..	9·3	50·6
4	14	2	53·0	73 $\frac{1}{4}$	832	1520	2352	94	61	155	9·7	54·7
5a	15	2 $\frac{3}{4}$	54·0	56 $\frac{3}{4}$	903	1530	2483	165	121	286	6·7	57·2
5b	16	0 $\frac{1}{2}$	53·1	78	935	1660	2595	197	201	398	9·1	56·3
6a	21	0 $\frac{1}{2}$	53·7	76 $\frac{3}{4}$	1210	2183	3393	472	724	1196	6·8	55·6
6b	22	3 $\frac{1}{4}$	54·2	88 $\frac{1}{2}$	1326	2393	3719	588	934	1522	7·1	55·4
7a	27	3 $\frac{1}{2}$	54·3	98 $\frac{1}{4}$	1612	3003	4615	874	1544	2418	6·5	53·7
7b	27	2 $\frac{1}{4}$	54·3	102	1597	3137	4734	859	1678	2537	6·8	50·9
8a	30	3	52·8	133 $\frac{1}{2}$	1759	3880	5639	1021	2421	3442	8·2	45·3
8b	31	2 $\frac{3}{4}$	52·3	129 $\frac{1}{4}$	1787	3813	5600	1049	2354	3403	7·8	46·9
9a	32	2 $\frac{1}{2}$	51·5	176 $\frac{3}{4}$	1858	4777	6635	1120	3318	4438	10·5	38·9
9b	19	2 $\frac{1}{4}$	48·5	205	1155	3130	4285	417	1671	2088	21·6	36·9
10a	15	0 $\frac{1}{2}$	49·5	155	905	2213	3118	167	754	921	20·7	40·9
10b	18	2 $\frac{1}{2}$	51·0	111 $\frac{3}{4}$	1060	2360	3420	322	901	1223	11·8	44·9
11a	22	1 $\frac{1}{2}$	51·0	128 $\frac{1}{4}$	1270	2503	3773	532	1044	1576	11·2	50·8
11b	22	1 $\frac{1}{2}$	51·2	161 $\frac{3}{4}$	1307	2693	4000	569	1234	1803	14·1	48·5
12a	28	0 $\frac{1}{2}$	53·4	146 $\frac{3}{4}$	1648	3230	4878	910	1771	2681	9·8	51·0
12b	26	2 $\frac{1}{4}$	53·5	155	1577	3087	4664	839	1628	2467	10·9	51·1
13a	26	0 $\frac{3}{4}$	54·3	154 $\frac{1}{4}$	1575	2993	4568	837	1534	2371	10·9	52·6
13b	27	0 $\frac{1}{2}$	53·8	139	1600	3037	4637	862	1578	2440	9·5	52·7
14a	27	1 $\frac{1}{2}$	53·7	114 $\frac{1}{4}$	1583	3053	4636	845	1594	2439	7·8	51·9
14b	27	0 $\frac{1}{4}$	53·2	121 $\frac{3}{4}$	1563	3103	4666	825	1644	2469	8·5	50·4
15a	25	1 $\frac{1}{2}$	53·8	146	1510	2877	4387	772	1418	2190	10·7	52·5
15b	28	0	54·0	100 $\frac{3}{4}$	1614	3090	4704	876	1631	2507	6·7	52·2
16a	32	2	52·0	165	1856	4117	5973	1118	2658	3776	9·8	45·1
16b	32	3	51·7	193 $\frac{1}{4}$	1889	4207	6096	1151	2748	3899	11·4	44·9
17a	24	0 $\frac{1}{4}$	54·1	107 $\frac{1}{2}$	1409	2700	4109	671	1241	1912	8·3	52·2
17b	26	1 $\frac{1}{2}$	54·3	114 $\frac{1}{4}$	1548	2970	4518	810	1511	2321	8·0	52·1
18a	15	1 $\frac{1}{4}$	54·5	94 $\frac{1}{4}$	929	1720	2649	191	261	452	11·3	54·0
18b	16	1 $\frac{1}{4}$	54·6	73 $\frac{3}{4}$	963	1743	2706	225	284	509	8·3	55·3
19	24	0 $\frac{1}{2}$	53·0	158	1435	2743	4178	697	1284	1981	12·4	52·3
20	12	0 $\frac{1}{4}$	51·5	99 $\frac{1}{4}$	722	1433	2155	— 16	— 26	— 42	16·0	50·4
21	15	2	52·5	78	893	1746	2639	155	287	442	9·6	51·2
22	13	3 $\frac{1}{4}$	53·8	102 $\frac{1}{2}$	847	1567	2414	109	108	217	13·8	54·0



EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XIX.—PRODUCE OF THE 18TH SEASON, 1860-1. SEED (Red Rostock)  
sown November 5, 1860; Crop cut August 20, and carted August 27, 1861.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).							INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.
	Dressed Corn.			Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.		
	Quantity.	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	15	1½	57·6	116½	1001	1768	2769	265	514	779	13·2	56·6
1	12	3¾	57·6	84	828	1387	2215	92	133	225	11·3	59·7
2	34	3½	60·5	92	2202	3101	5303	1466	1847	3313	4·4	71·0
3	11	1½	57·4	84½	736	1254	1990	..	..	..	13·0	58·7
4	11	3½	58·0	175	863	1330	2193	127	76	203	25·4	64·9
5a	15	1¾	59·1	134½	1047	1493	2540	311	239	550	14·8	70·1
5b	15	1½	59·0	174½	1082	1610	2692	346	356	702	19·2	67·2
6a	27	1½	59·5	128½	1755	2573	4328	1019	1319	2338	7·9	68·2
6b	27	3¼	59·4	167	1818	2683	4501	1082	1429	2511	10·1	67·8
7a	35	2¼	59·0	167	2263	3501	5764	1527	2247	3774	8·0	64·6
7b	34	1½	59·0	161½	2183	3555	5738	1447	2301	3748	8·0	61·4
8a	36	0	58·3	190½	2290	3913	6203	1554	2659	4213	9·1	58·5
8b	34	0½	58·5	196½	2190	3795	5985	1454	2541	3995	9·8	57·7
9a	33	3	56·8	244½	2162	4445	6607	1426	3191	4617	12·8	48·6
9b	13	3	53·9	167½	909	2170	3079	173	916	1089	22·6	41·9
10a	12	3½	55·0	145½	854	1930	2784	118	676	794	20·5	44·2
10b	15	3¾	55·5	148½	1033	2163	3196	297	909	1206	16·8	47·8
11a	23	1¾	55·3	160¾	1455	2577	4032	719	1323	2042	12·4	56·5
11b	25	0¾	55·8	172	1578	2645	4223	842	1391	2233	12·2	59·7
12a	32	1½	58·1	129½	2009	3192	5201	1273	1938	3211	6·9	63·0
12b	33	1½	58·7	182	2144	3337	5481	1408	2083	3491	9·3	64·3
13a	33	1½	59·9	170½	2168	3318	5486	1432	2064	3496	8·5	65·4
13b	35	0	60·0	205	2304	3490	5794	1568	2236	3804	9·8	66·0
14a	33	0½	59·1	171½	2125	3377	5502	1389	2123	3512	8·8	62·9
14b	33	3¾	59·8	160½	2173	3303	5476	1437	2049	3486	8·0	65·8
15a	34	1½	60·0	127½	2188	3318	5506	1452	2064	3516	6·2	65·9
15b	34	3	60·2	158½	2249	3478	5727	1513	2224	3737	7·6	64·7
16a	36	1¾	58·0	222	2338	4423	6761	1602	3169	4771	10·5	52·8
16b	37	2	58·6	233	2432	4343	6775	1696	3089	4785	10·6	56·0
17a	19	1	59·3	89½	1229	1753	2982	493	499	992	7·9	70·1
17b	18	0¾	59·1	92½	1166	1663	2829	430	409	839	8·6	70·1
18a	32	1½	59·6	119½	2050	3094	5144	1314	1840	3154	6·2	66·2
18b	33	1½	59·5	134½	2122	3324	5446	1386	2070	3456	6·8	63·8
19	32	2	58·8	197½	2107	3238	5345	1371	1984	3355	10·3	65·1
20	13	0½	57·9	111½	872	1468	2340	136	214	350	14·6	59·4
21	16	1¾	58·2	152½	1109	1640	2749	373	386	759	15·9	67·6
22	19	2¾	58·5	152½	1306	1957	3263	570	703	1273	13·2	66·7

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XX.—PRODUCE of the 19TH SEASON, 1861-2. SEED (Red Rostock)  
sown October 25, 1861; Crop cut August 29, and carted September 12, 1862.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.			Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.			Total Produce.
	Quantity.	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
0	19	3½	58·5	65	1228	2030	3258	232	317	549	5·6	60·5
1	16	2¾	58·0	55½	1024	1748	2772	28	35	63	5·7	58·6
2	38	1½	61·0	107	2447	4195	6642	1451	2482	3933	4·6	58·3
3	16	0	57·8	73½	996	1713	2709	..	..	..	8·0	58·2
4	16	2½	58·5	75½	1049	1662	2711	53	-51	2	7·7	63·2
5 <i>a</i>	17	3¼	59·0	58¾	1119	1840	2959	123	127	250	5·5	60·8
5 <i>b</i>	17	2½	59·0	60¾	1101	1860	2961	105	147	252	5·9	59·2
6 <i>a</i>	27	2	59·5	78½	1715	2839	4554	719	1126	1845	4·8	60·4
6 <i>b</i>	28	3¼	59·8	76½	1797	3100	4897	801	1387	2188	4·4	58·0
7 <i>a</i>	35	2¼	59·3	92¾	2200	3906	6106	1204	2193	3397	4·4	56·3
7 <i>b</i>	36	0¾	59·5	110¾	2265	3913	6178	1269	2200	3469	5·2	57·9
8 <i>a</i>	39	3	59·2	122¾	2477	4723	7200	1481	3010	4491	5·2	52·4
8 <i>b</i>	39	0½	59·0	141¼	2452	4635	7087	1456	2922	4378	6·1	52·9
9 <i>a</i>	43	1¾	59·5	104½	2688	6050	8738	1692	4337	6029	4·0	44·4
9 <i>b</i>	25	3½	56·3	186¼	1641	3256	4897	645	1543	2188	12·8	50·4
10 <i>a</i>	23	0¼	56·5	154½	1457	2593	4050	461	880	1341	11·9	56·2
10 <i>b</i>	24	3¼	57·5	172¾	1600	2843	4443	604	1130	1734	12·1	56·3
11 <i>a</i>	26	2¾	58·0	156	1706	2842	4548	710	1129	1839	10·1	60·0
11 <i>b</i>	27	0¼	58·0	166	1734	2873	4607	738	1160	1898	10·6	60·4
12 <i>a</i>	34	1¼	58·0	104¼	2096	3649	5745	1100	1936	3036	5·2	57·4
12 <i>b</i>	33	0¾	58·0	99¾	2025	3609	5634	1029	1896	2925	5·2	56·1
13 <i>a</i>	31	3¾	58·0	100¾	1953	3589	5542	957	1876	2833	5·5	54·4
13 <i>b</i>	32	2¾	58·0	124½	2019	3672	5691	1023	1959	2982	6·6	55·0
14 <i>a</i>	30	1¾	58·0	120	1886	3397	5283	890	1684	2574	6·8	55·5
14 <i>b</i>	32	0¼	58·1	144¼	2008	3550	5558	1012	1837	2849	7·7	56·6
15 <i>a</i>	30	1¾	58·3	101	1872	3396	5268	876	1683	2559	5·7	55·1
15 <i>b</i>	32	2¾	58·3	125	2029	3758	5787	1033	2045	3078	6·6	54·0
16 <i>a</i>	36	1¼	58·0	120¾	2225	4527	6752	1229	2814	4043	5·7	49·2
16 <i>b</i>	36	0½	57·5	155	2233	4497	6730	1237	2784	4021	7·5	49·7
17 <i>a</i>	27	3½	58·1	128¼	1747	3080	4827	751	1367	2118	7·9	56·7
17 <i>b</i>	27	2¼	58·1	85	1685	3077	4762	689	1364	2053	5·3	54·8
18 <i>a</i>	18	1½	58·5	92	1168	1993	3161	172	280	452	8·6	58·6
18 <i>b</i>	18	2¾	58·5	102	1195	2140	3335	199	427	626	9·3	55·9
19	23	1½	57·2	143¾	1479	2653	4132	483	940	1423	10·8	55·8
20	12	1½	57·3	108	818	1517	2335	-178	-196	-374	15·2	53·9
21	20	1½	58·1	90½	1273	2192	3465	277	479	756	7·6	58·1
22	20	0¼	58·0	86¾	1250	2180	3430	254	467	721	7·5	57·3

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR  
ON THE SAME LAND.

APPENDIX.—TABLE XXI.—PRODUCE of the 20TH SEASON, 1862-3. SEED (Red Rostock)  
sown November 17, 1862; Crop cut August 10, and carted August 18, 1863.

Plots.	PRODUCE PER ACRE, &c. (For the Manures see pp. 162 and 163).						INCREASE PER ACRE BY MANURE.			Offal Corn to 100 Dressed.	Corn to 100 Straw.	
	Dressed Corn.		Offal Corn.	Total Corn.	Straw and Chaff.	Total Produce (Corn and Straw).	Corn.	Straw and Chaff.	Total Produce.			
	Quantity.	Weight per Bushel.										
	Bush.	Pecks.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
0	22	0½	62·6	42½	1429	1825	3,254	302	225	527	3·1	78·3
1	20	3	62·8	31½	1334	1745	3,079	207	145	352	2·4	76·4
2	44	0	63·1	109½	2886	4279	7,165	1759	2679	4438	4·0	67·5
3	17	1	62·7	47½	1127	1600	2,727	..	..	..	4·4	70·4
4	20	1	62·3	41½	1303	1654	2,957	176	54	230	3·3	78·8
5a	19	2½	63·0	46½	1283	1687	2,970	156	87	243	3·4	76·1
5b	19	3	63·0	52½	1296	1768	3,064	169	168	337	4·2	73·3
6a	39	1½	62·3	69½	2522	3714	6,236	1395	2114	3509	2·8	67·9
6b	39	3	62·3	58½	2534	3716	6,250	1407	2116	3523	2·4	68·2
7a	53	1¼	62·6	140	3477	5853	9,330	2350	4253	6603	4·2	59·4
7b	54	0	62·5	132½	3507	5878	9,385	2380	4278	6658	3·9	59·7
8a	56	2½	62·3	145½	3668	6715	10,383	2541	5115	7656	4·1	54·6
8b	54	3¼	62·3	144½	3559	6489	10,048	2432	4889	7321	4·2	54·8
9a	55	2¼	62·1	123½	3576	6312	9,888	2449	4712	7161	3·6	56·7
9b	41	1¾	62·5	134	2723	4197	6,920	1596	2597	4193	5·2	64·9
10a	39	0½	62·6	134½	2587	3481	6,068	1460	1881	3341	5·5	74·3
10b	43	2¼	62·8	123½	2858	4056	6,914	1731	2456	4187	4·5	70·5
11a	45	0	62·5	167	2979	4233	7,212	1852	2633	4485	5·9	70·4
11b	46	2	62·1	171½	3060	4459	7,519	1933	2859	4792	5·9	68·6
12a	54	2¾	62·1	133½	3533	5443	8,976	2406	3843	6249	3·9	64·9
12b	53	1	62·2	141½	3454	5365	8,819	2327	3765	6092	4·3	64·4
13a	53	1	62·6	119	3453	5739	9,192	2326	4139	6465	3·6	60·2
13b	53	1¼	62·5	107½	3439	5799	9,238	2312	4199	6511	3·2	59·3
14a	54	1¾	62·5	125½	3527	5459	8,986	2400	3859	6259	3·7	64·6
14b	53	1¾	62·5	110½	3450	5299	8,749	2323	3699	6022	3·3	65·1
15a	48	1¼	62·5	95½	3114	5162	8,276	1987	3562	5549	3·2	60·3
15b	48	0	62·9	109	3127	5113	8,240	2000	3513	5513	3·6	61·2
16a	56	2¾	62·4	175½	3710	7007	10,717	2583	5407	7990	5·0	53·0
16b	55	0¼	62·3	172½	3607	6725	10,332	2480	5125	7605	5·0	53·6
17a	21	0½	62·8	42	1370	1918	3,288	243	318	561	3·2	71·4
17b	21	1½	62·8	46	1389	1903	3,292	262	303	565	3·4	73·0
18a	46	1½	62·6	105½	3006	4883	7,889	1879	3283	5162	3·6	61·6
18b	46	0¾	62·8	111¼	3009	4728	7,737	1882	3128	5010	3·8	63·6
19	46	2¾	62·9	118	3054	4523	7,577	1927	2923	4850	4·0	67·5
20	17	2¾	62·5	32	1137	1472	2,609	10	-128	-118	2·9	77·3
21	27	2½	62·5	69½	1796	2483	4,279	669	883	1552	4·0	72·4
22	29	3	62·4	52½	1907	2692	4,599	780	1092	1872	2·8	70·9



EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF  
APPENDIX.—TABLE XXII.—DRESSED CORN

Plots.	HARVESTS.											
	1844. <sup>1</sup>	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	
	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	p
0	19 3 $\frac{1}{2}$	32 0	28 1 $\frac{3}{4}$	30 2 $\frac{3}{4}$	19 0 $\frac{1}{2}$	..	19 1 $\frac{1}{2}$	18 3 $\frac{1}{2}$	15 0 $\frac{3}{4}$	9 0 $\frac{3}{4}$	26 1 $\frac{1}{2}$	1 $\frac{1}{2}$
1	16 3	26 1 $\frac{1}{4}$	22 0 $\frac{3}{4}$	32 1	16 0 $\frac{1}{2}$	..	..	18 1 $\frac{1}{4}$	13 1	6 1 $\frac{1}{2}$	24 1 $\frac{1}{2}$	1 $\frac{1}{2}$
2	20 1 $\frac{3}{4}$	32 0	27 0 $\frac{1}{2}$	29 3 $\frac{1}{4}$	25 2 $\frac{3}{4}$	31 0	28 2	29 2 $\frac{1}{2}$	27 2 $\frac{1}{4}$	19 0 $\frac{1}{2}$	41 0 $\frac{1}{2}$	1 $\frac{1}{2}$
3	15 0	23 0 $\frac{3}{4}$	17 3 $\frac{1}{4}$	16 3 $\frac{1}{4}$	14 3	19 1	15 3 $\frac{1}{4}$	15 3 $\frac{1}{2}$	13 3 $\frac{1}{4}$	5 3 $\frac{1}{4}$	21 0 $\frac{1}{2}$	1 $\frac{1}{2}$
4	14 2 $\frac{1}{4}$	29 2 $\frac{1}{2}$	25 3 $\frac{3}{4}$	27 1 $\frac{3}{4}$	24 0 $\frac{1}{2}$	30 0	27 3	28 0 $\frac{1}{2}$	13 1 $\frac{1}{2}$	7 1	23 3 $\frac{1}{2}$	1 $\frac{1}{2}$
5a		22 2 $\frac{1}{4}$	19 0 $\frac{1}{2}$	29 0	29 3 $\frac{1}{2}$	37 1 $\frac{1}{4}$	29 3 $\frac{1}{2}$	36 0	16 3	10 0	24 1 $\frac{1}{2}$	1 $\frac{1}{2}$
5b	15 2 $\frac{1}{4}$	26 3 $\frac{3}{4}$	23 2 $\frac{1}{2}$	32 2	30 3 $\frac{1}{2}$	39 3 $\frac{1}{2}$	30 3	37 3 $\frac{3}{4}$	17 0 $\frac{1}{4}$	10 1	24 0	0
6a		20 1 $\frac{3}{4}$	24 1 $\frac{3}{4}$	24 3 $\frac{1}{4}$	24 3 $\frac{1}{4}$	36 1 $\frac{1}{2}$	30 0 $\frac{1}{2}$	33 1 $\frac{3}{4}$	20 3	16 3 $\frac{1}{4}$	33 2 $\frac{3}{4}$	2 $\frac{3}{4}$
6b	15 1	28 2 $\frac{3}{4}$	29 0 $\frac{1}{4}$	24 1 $\frac{1}{2}$	26 3	37 3 $\frac{3}{4}$	29 3 $\frac{3}{4}$	31 0 $\frac{1}{2}$	20 3 $\frac{1}{4}$	19 1	34 2 $\frac{1}{4}$	2 $\frac{3}{4}$
7a		22 3 $\frac{1}{4}$	27 3 $\frac{1}{4}$	30 3 $\frac{1}{4}$	30 3 $\frac{1}{4}$	38 2 $\frac{1}{4}$	32 1	36 3 $\frac{1}{2}$	26 2 $\frac{1}{2}$	23 2 $\frac{1}{2}$	45 2 $\frac{1}{2}$	2 $\frac{1}{2}$
7b	15 2	26 2 $\frac{3}{4}$	31 3	25 1 $\frac{1}{2}$	29 3 $\frac{1}{4}$	37 3 $\frac{3}{4}$	32 0 $\frac{1}{4}$	37 1 $\frac{1}{2}$	26 3 $\frac{1}{2}$	23 2 $\frac{1}{4}$	45 1 $\frac{1}{2}$	1 $\frac{1}{2}$
8a		22 3 $\frac{1}{4}$	32 1 $\frac{1}{4}$	19 3	22 3	28 3	28 3	26 0 $\frac{3}{4}$	27 3 $\frac{1}{2}$	22 1 $\frac{1}{4}$	47 1 $\frac{1}{2}$	1 $\frac{1}{2}$
8b	15 0 $\frac{3}{4}$	27 0 $\frac{1}{4}$	29 0 $\frac{1}{4}$	30 3	19 0 $\frac{3}{4}$	31 2 $\frac{1}{2}$	30 1	27 2 $\frac{1}{4}$	27 0 $\frac{3}{4}$	24 2 $\frac{1}{4}$	49 2 $\frac{1}{2}$	2 $\frac{1}{2}$
9a		23 2 $\frac{3}{4}$	22 3	18 2 $\frac{1}{2}$	30 2 $\frac{3}{4}$	30 1 $\frac{1}{2}$	31 1 $\frac{1}{2}$	25 2	11 1	38 3		
9b	19 2 $\frac{1}{4}$	33 1 $\frac{1}{2}$	28 3 $\frac{1}{2}$	26 0	25 0 $\frac{1}{4}$	22 1 $\frac{1}{2}$	27 2 $\frac{3}{4}$	29 0 $\frac{1}{4}$	24 1 $\frac{3}{4}$	10 1 $\frac{3}{4}$	38 3 $\frac{1}{2}$	
10a		27 1 $\frac{1}{2}$	25 3	19 1	32 2 $\frac{1}{4}$	26 3 $\frac{3}{4}$	28 3 $\frac{1}{2}$	21 3 $\frac{1}{2}$	9 3 $\frac{3}{4}$	34 1 $\frac{1}{2}$		
10b	15 1 $\frac{3}{4}$	31 3 $\frac{1}{4}$	17 2 $\frac{1}{2}$	25 2 $\frac{3}{4}$	25 0 $\frac{1}{2}$	32 1 $\frac{1}{4}$	17 3 $\frac{3}{4}$	28 2 $\frac{1}{2}$	22 0 $\frac{1}{2}$	15 2	39 0 $\frac{3}{4}$	
11a		23 1 $\frac{3}{4}$	30 3 $\frac{1}{2}$	29 1 $\frac{1}{2}$	35 0 $\frac{1}{2}$	30 3	32 2 $\frac{3}{4}$	24 0 $\frac{1}{2}$	17 2	44 2		
11b	17 0 $\frac{3}{4}$	30 3	30 0 $\frac{1}{4}$	29 1 $\frac{1}{4}$	24 3	32 1 $\frac{1}{2}$	29 1 $\frac{1}{2}$	31 2 $\frac{1}{2}$	22 1 $\frac{1}{2}$	18 2 $\frac{3}{4}$	43 0 $\frac{1}{2}$	
12a		24 1 $\frac{1}{2}$	29 2	29 3	35 3 $\frac{1}{4}$	29 3 $\frac{3}{4}$	32 3	24 1 $\frac{1}{2}$	22 0	45 3 $\frac{1}{4}$		
12b	15 2	28 2 $\frac{1}{4}$	28 2 $\frac{3}{4}$	27 0	26 0 $\frac{3}{4}$	34 1 $\frac{1}{4}$	30 3 $\frac{3}{4}$	32 2 $\frac{1}{4}$	24 1 $\frac{1}{2}$	23 3 $\frac{1}{4}$	45 1 $\frac{1}{2}$	
13a		24 0	29 2 $\frac{1}{2}$	29 1	34 3 $\frac{1}{4}$	31 3 $\frac{3}{4}$	30 2 $\frac{3}{4}$	24 0	22 1 $\frac{1}{4}$	45 0 $\frac{1}{2}$		
13b	16 1 $\frac{1}{4}$	25 0	29 1 $\frac{3}{4}$	27 1 $\frac{1}{2}$	25 3 $\frac{1}{4}$	34 2 $\frac{1}{2}$	30 1 $\frac{1}{2}$	30 3 $\frac{1}{4}$	23 3 $\frac{1}{2}$	23 2 $\frac{1}{4}$	43 3 $\frac{1}{4}$	
14a		23 2 $\frac{1}{2}$	28 0 $\frac{3}{4}$	28 0 $\frac{1}{4}$	34 1 $\frac{1}{4}$	31 1 $\frac{1}{2}$	31 0 $\frac{1}{4}$	24 1	21 2	45 1 $\frac{1}{2}$		
14b	15 3	27 1	26 2 $\frac{1}{2}$	26 3 $\frac{3}{4}$	25 2 $\frac{1}{2}$	31 1 $\frac{1}{4}$	31 1 $\frac{1}{2}$	31 0 $\frac{1}{2}$	25 0 $\frac{1}{4}$	23 0 $\frac{3}{4}$	44 0 $\frac{1}{2}$	
15a		31 3 $\frac{1}{4}$	32 3	22 3 $\frac{1}{2}$	31 3 $\frac{1}{4}$	26 0 $\frac{1}{4}$	27 0 $\frac{1}{2}$	23 1 $\frac{1}{2}$	19 0	43 1 $\frac{1}{4}$		
15b	16 3 $\frac{1}{4}$	32 3 $\frac{3}{4}$	27 2 $\frac{3}{4}$	32 0	24 2 $\frac{3}{4}$	30 0 $\frac{3}{4}$	30 3 $\frac{1}{2}$	30 2 $\frac{1}{2}$	25 0 $\frac{1}{2}$	23 2 $\frac{1}{2}$	43 1	
16a		23 3	29 1 $\frac{1}{4}$	29 3 $\frac{1}{4}$	33 1 $\frac{1}{2}$	33 2 $\frac{1}{2}$	36 3 $\frac{1}{4}$	28 3 $\frac{1}{2}$	24 1 $\frac{1}{2}$	49 2 $\frac{1}{4}$		
16b	19 3 $\frac{1}{4}$	32 3 $\frac{1}{4}$	30 1	34 2 $\frac{1}{4}$	30 1 $\frac{3}{4}$	33 3 $\frac{3}{4}$	33 3	36 2 $\frac{3}{4}$	28 0	25 3 $\frac{1}{4}$	50 0 $\frac{3}{4}$	
17a		33 2 $\frac{3}{4}$	33 3	27 2 $\frac{1}{2}$	34 1	31 1	31 3 $\frac{1}{2}$	25 2	8 1 $\frac{3}{4}$	45 3		
17b	18 3 $\frac{3}{4}$	32 0 $\frac{3}{4}$	30 2	35 1 $\frac{3}{4}$	28 3 $\frac{1}{2}$	33 1 $\frac{1}{2}$	29 2 $\frac{1}{2}$	30 2 $\frac{1}{4}$	24 1 $\frac{1}{2}$	8 3 $\frac{3}{4}$	42 2 $\frac{1}{4}$	
18a		31 0	32 0 $\frac{1}{4}$	26 3	32 1 $\frac{1}{4}$	29 3 $\frac{1}{4}$	30 3 $\frac{1}{4}$	13 3	17 3 $\frac{1}{4}$	24 0		
18b	20 3 $\frac{3}{4}$	33 0 $\frac{1}{4}$	21 1	29 1 $\frac{1}{2}$	26 2 $\frac{3}{4}$	33 2 $\frac{1}{4}$	28 2 $\frac{1}{2}$	31 0 $\frac{3}{4}$	14 3 $\frac{3}{4}$	20 3	23 2 $\frac{3}{4}$	
19	24 1 $\frac{1}{4}$	34 3	28 3	32 3	29 1 $\frac{3}{4}$	29 2 $\frac{1}{4}$	29 0	30 1	24 3 $\frac{3}{4}$	19 1 $\frac{1}{4}$	41 0 $\frac{3}{4}$	
20	..	24 2 $\frac{3}{4}$	..	20 0 $\frac{3}{4}$	16 0 $\frac{1}{2}$	..	14 0	14 1	14 0 $\frac{3}{4}$	5 3 $\frac{1}{2}$	22 3	
21	..	..	..	..	..	..	..	..	19 1 $\frac{1}{4}$	12 3 $\frac{1}{4}$	32 0 $\frac{1}{4}$	
22	..	..	..	..	..	..	..	..	19 2 $\frac{1}{4}$	10 1	31 3	

<sup>1</sup> See foot-note No. 5, to Appendix Table I. p. 147.

<sup>2</sup> For Plots 0, 1, 20, 21, and 22 the averages are for only 19, 18, 17, 13, and 13 years respectively.

<sup>3</sup> On Plots 17 and 18 the manures have alternated during the last 12 years; that is, ammonia-salts on Plots 17, and the mixed mineral manure on Plots 18, in one year; mineral manure on Plots 17, and ammonia-salts on Plots 18, in the next year, and so on.



WHEAT YEAR AFTER YEAR ON THE SAME LAND.

n BUSHELS and PECKS, per Acre, per Annum.

HARVESTS.										AVERAGE				Plots.
1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	Of 20 Years, <sup>2</sup> 1844-63.	Of last 12 Years, 1852-63.				
sh. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.	bush. pks.			
17 0	18 1½	18 2½	20 3	21 2½	14 1½	15 1½	19 3½	22 0½	20 1½	18 1		0		
18 2	17 0½	17 2	16 1½	19 3	12 1½	12 3½	16 2½	20 3	18 1	16 1½		1		
34 2½	36 1½	41 0	38 3½	36 0½	32 1½	34 3½	38 1½	44 0	32 1½	35 1½		2		
17 0	14 2	19 3½	18 0	18 1½	12 3½	11 1½	16 0	17 1	16 1	15 2		3		
18 2½	16 1½	22 1½	19 0½	19 0½	14 2	11 3½	16 2½	20 1	20 2½	16 3½		4		
18 2	18 3½	22 3½	18 2½	20 2½	15 2½	15 1½	17 3½	19 2½	22 0½	18 1		5a		
18 0½	20 1½	24 2½	19 1	20 2½	16 0½	15 1½	17 2½	19 3	23 1	18 2½		5b		
27 3	27 1½	35 1½	28 2½	29 2½	21 0½	27 1½	27 2	39 1½	27 1½	27 3½		6a		
28 1	28 0½	35 1½	29 0½	30 0½	22 3½	27 3½	28 3½	39 3	28 1½	28 3		6b		
32 2½	37 1	43 1½	38 2½	34 2½	27 3½	35 2½	35 2½	53 1½	33 1½	36 1		7a		
33 1½	36 2½	46 1½	39 2½	34 2½	27 2½	34 1½	36 0½	54 0	33 3	36 2½		7b		
29 3	40 0½	47 3	41 3½	34 3½	30 3	36 0	39 3	56 2½	32 2	37 3½		8a		
33 0½	37 3½	48 3½	41 3½	34 0½	31 2½	34 0½	39 0½	54 3½	33 1½	38 0½		8b		
29 2½	32 1½	43 3	37 2½	30 0	32 2½	33 3	43 1½	55 2½	31 1½	34 2		9a		
25 1½	26 0	36 0½	23 2	24 2½	19 2½	13 3	25 3½	41 1½	26 0½	25 3½		9b		
19 3½	24 0½	29 0½	22 3½	18 3½	15 0½	12 3½	23 0½	39 0½	24 0	22 2½		10a		
28 0½	27 2½	34 2	27 3	25 2	18 2½	15 3½	24 3½	43 2½	25 3½	26 3½		10b		
18 3	31 3½	39 0	30 3½	26 3½	22 1½	23 1½	26 2½	45 0	29 0½	29 1		11a		
24 2½	30 2½	39 0	33 0½	27 3½	22 1½	25 0	27 0½	46 2	29 1½	30 0½		11b		
30 0½	33 3½	43 3½	37 3½	34 2½	28 0½	32 1½	34 1½	54 2½	32 1½	35 0½		12a		
23 2	32 3½	43 2	37 0½	34 3	26 2½	33 1	33 0	53 1	32 1	35 0		12b		
29 0	32 1½	42 3	37 0½	34 0½	26 0½	33 1½	31 3½	53 1	31 2½	34 1½		13a		
32 2	30 3½	43 2	37 0½	34 3½	27 0½	35 0	32 2½	53 1½	31 3½	34 3½		13b		
29 3	35 0½	43 3	37 3½	34 1½	27 1½	33 0½	30 1½	54 1½	31 3½	34 3½		14a		
33 1½	34 0½	42 3½	38 1½	34 2½	27 0½	33 3½	32 0½	53 1½	31 3½	35 0½		14b		
31 3½	30 0½	42 1½	35 1½	34 0½	25 1½	34 1½	30 1½	48 1½	31 0	33 0½		15a		
33 3	32 0	44 1½	37 2	35 0½	28 0	34 3	32 2½	48 0	32 0½	34 3½		15b		
33 1½	38 0½	48 3½	41 3	34 3½	32 2	36 1½	36 1½	56 2½	35 0½	38 2		16a		
32 2	37 3	50 0	42 0½	34 1½	32 3	37 2	36 0½	55 0½	35 3	38 2		16b		
18 3½	31 2½	26 2½	33 1½	21 1½	24 0½	19 1	27 3½	21 0½	27 1½	18 3½	18 3½ <sup>4</sup>	(17a) (17b) (18a) (18b)	3	
17 0½	30 1½	25 3½	33 3½	19 3	26 1½	18 0½	27 2½	21 1½	27 2½	18 3½				
32 3½	17 3½	41 0½	22 3½	32 3½	15 1½	32 1½	18 1½	46 1½	27 2½	18 3½				
33 1½	18 0	40 0½	20 2½	32 2	16 1½	33 1½	18 2½	46 0½	27 0½	18 3½				
30 0½	32 1	41 2½	33 1½	30 2	24 0½	32 2	23 1½	46 2½	30 3½	31 2½			19	
17 2½	17 0½	19 2½	17 0	17 3½	12 0½	13 0½	12 1½	17 2½	16 1	15 2½			20	
24 1½	22 1½	24 0	24 1½	26 1½	15 2	16 1½	20 1½	27 2½	21 3½	22 0½			21	
24 2½	21 1½	23 0½	22 0	24 0½	13 3½	19 2½	20 0½	29 3	21 1½	21 2½			22	

<sup>4</sup> The average given for Plots 17 is that of 12 years mineral manure succeeding ammonia-salts (Plots 17 or 18); and that given for Plots 18, of 12 years ammonia-salts succeeding the mineral manure (Plots 17 or 18).

## EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF

## APPENDIX.—TABLE XXIII.—WEIGHTS

Plots.	HARVESTS.										
	1844. <sup>1</sup>	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	58.5	56.5	62.3	61.1	58.4	..	60.8	61.9	55.8	49.8	61.0
1	59.0	54.8	62.6	61.2	59.6	..	..	61.7	56.9	46.9	60.2
2	59.3	56.8	63.0	62.3	58.2	63.8	61.9	63.6	58.2	51.1	62.5
3	58.5	56.5	63.8	61.0	57.3	61.4	60.6	61.1	56.6	45.9	60.6
4	58.0	58.0	63.5	61.9	58.5	63.0	61.2	62.6	57.3	46.6	61.1
5a	58.3	57.5	{ 63.7 63.0 }	61.8	59.2	63.1	60.4	63.3	57.5	48.6	61.0
5b		57.3	{ 63.4 63.3 }	61.4	59.1	63.4	60.4	63.3	57.3	48.6	61.6
6a	60.0	57.8	{ 63.7 63.5 }	62.1	58.8	63.0	61.1	63.3	57.6	51.5	61.8
6b		57.0	{ 63.0 63.4 }	61.6	56.9	63.0	61.3	62.3	57.5	51.5	61.8
7a	60.3	57.0	{ 63.0 63.4 }	61.7	59.4	63.1	61.0	63.0	56.0	52.1	61.9
7b		56.3	{ 63.5 63.6 }	61.5	59.6	62.9	61.2	63.0	55.8	51.9	61.8
8a	61.3	56.3	{ 63.5 63.6 }	62.1	56.2	61.7	61.1	62.8	55.9	51.7	61.4
8b		58.3	{ 61.7 63.3 }	59.4	63.0	61.0	62.6	55.9	51.8	61.8	61.8
9a	62.3	58.3	{ 63.0 63.3 }	{ 62.5 61.0 }	56.7	62.8	60.4	62.4	55.6	47.4	60.7
9b		56.3	{ 61.3 63.3 }	58.3	62.3	60.8	62.0	55.3	46.9	60.7	60.7
10a	62.0	56.3	{ 63.6 63.8 }	61.5	58.1	62.3	60.2	61.9	55.9	48.6	60.5
10b		56.0	{ 63.3 63.2 }	61.2	57.8	62.3	61.1	62.5	57.3	49.5	61.6
11a	61.8	55.3	{ 63.3 63.2 }	61.6	59.6	62.6	61.0	62.3	55.6	50.7	61.1
11b		55.3	{ 63.0 63.4 }	61.8	57.9	63.0	61.1	62.5	55.9	51.1	61.2
12a	61.5	56.3	{ 63.0 63.5 }	62.0	59.3	64.3	61.5	63.1	57.4	52.0	62.2
12b		57.5	{ 63.4 63.2 }	61.8	59.2	64.3	61.4	62.5	57.3	51.9	62.2
13a	62.5	56.3	{ 63.5 63.2 }	62.5	57.9	64.1	60.2	62.6	57.5	52.1	62.2
13b		57.5	{ 62.3 63.0 }	58.4	58.8	64.1	61.0	62.3	57.1	51.9	62.2
14a	61.3	57.5	{ 63.0 63.4 }	62.8	58.8	64.3	61.1	62.9	56.9	51.9	62.2
14b		57.5	{ 62.8 63.4 }	58.5	64.3	61.5	62.8	56.7	52.4	62.2	62.2
15a	62.0	57.5	{ 62.5 63.0 }	63.0	58.1	64.2	61.5	62.7	57.4	51.6	62.1
15b		56.3	{ 62.6 62.7 }	56.9	64.1	61.0	62.9	56.8	51.7	62.4	62.4
16a	62.5	56.3	{ 62.5 62.7 }	62.3	60.0	64.5	60.3	63.5	55.0	52.3	61.7
16b		55.8	{ 62.3 62.8 }	59.7	59.7	64.4	61.5	63.1	56.9	48.6	62.2
17a	62.3	56.5	{ 62.8 62.0 }	62.3	59.2	64.0	61.2	63.0	57.0	52.6	61.2
17b		56.5	{ 62.7 62.0 }	59.6	59.6	64.0	60.9	62.4	56.7	52.6	61.0
18a	62.0	56.5	{ 62.8 62.0 }	62.3	59.2	64.0	61.2	63.0	57.0	52.6	61.2
18b		56.5	{ 62.7 62.0 }	59.6	59.6	64.0	60.9	62.4	56.7	52.6	61.0
19	61.8	57.0	62.0	62.8	56.2	63.9	60.8	62.4	56.1	52.4	61.7
20	..	56.0	..	62.5	58.3	..	59.1	60.8	56.6	47.5	60.8
21	..	..	..	..	..	..	..	61.9	56.9	50.3	61.2
22	..	..	..	..	..	..	..		55.9	49.3	61.0

<sup>1</sup> See foot-note No. 5, to Appendix Table I, p. 147.<sup>2</sup> For Plots 0, 1, 20, 21, and 22, the averages are for only 19, 18, 17, 13, and 13 years respectively.<sup>3</sup> On Plots 17 and 18 the manures have alternated during the last 12 years; that is, ammonia-salts on Plots 17, and the mixed mineral manure on Plots 18, in one year; mineral manure on Plots 17, and ammonia-salts on Plots 18, in the next year, and so on.

# WHEAT YEAR AFTER YEAR ON THE SAME LAND.

per BUSHEL of DRESSED CORN, each Year.

HARVESTS.									AVERAGE.		Plots.
1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	Of 20 Years, <sup>2</sup> 1844-63.	Of last 12 Years, 1852-63.	
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	* lbs.	lbs.	lbs.	lbs.	
60·7	56·8	59·0	61·2	54·0	53·5	57·6	58·5	62·6	58·4	57·5	0
60·5	56·3	59·0	60·7	55·0	52·8	57·6	58·0	62·8	58·1	57·2	1
62·0	58·6	60·4	62·6	56·5	55·5	60·5	61·0	63·1	60·0	59·3	2
59·2	54·3	58·3	60·4	52·5	52·6	57·4	57·8	62·7	57·9	56·5	3
59·5	55·5	58·8	61·1	55·0	53·0	58·0	58·5	62·3	58·7	57·2	4
59·9	56·5	59·0	61·5	56·0	54·0	59·1	59·0	63·0	59·1	57·9	5a
60·1	56·2	58·8	61·4	56·0	53·1	59·0	59·0	63·0	59·0	57·8	5b
60·3	58·2	59·9	62·1	56·5	53·7	59·5	59·5	62·3	59·6	58·6	6a
60·9	58·5	59·8	62·1	56·5	54·2	59·4	59·8	62·3	59·5	58·7	6b
59·4	58·0	60·5	61·9	55·9	54·3	59·0	59·3	62·6	59·5	58·4	7a
59·5	57·6	60·3	62·3	55·9	54·3	58·9	59·5	62·5	59·4	58·3	7b
58·8	56·8	60·8	61·8	54·0	52·8	58·3	59·2	62·3	58·9	57·8	8a
58·7	57·1	60·6	61·7	53·4	52·3	58·5	59·0	62·3	59·1	57·8	8b
58·3	57·2	60·1	60·8	54·5	51·5	56·8	59·5	62·1	58·4	57·1	9a
57·3	56·3	58·0	58·8	50·5	48·5	53·9	56·3	62·5	57·7	55·4	9b
57·1	55·6	58·0	59·6	51·5	49·5	55·0	56·5	62·6	57·8	55·9	10a
58·9	57·2	58·6	61·4	52·5	51·0	55·5	57·5	62·8	58·6	57·0	10b
55·3	57·3	58·5	60·5	51·4	51·0	55·3	58·0	62·5	58·3	56·4	11a
56·3	57·5	58·0	60·4	51·3	51·2	55·8	58·0	62·1	58·3	56·6	11b
59·5	58·7	60·4	62·1	54·5	53·4	58·1	58·0	62·1	59·4	58·2	12a
60·2	58·8	60·4	62·1	54·8	53·5	58·7	58·0	62·2	59·5	58·3	12b
59·9	58·6	60·6	62·1	55·0	54·3	59·9	58·0	62·6	59·6	58·6	13a
60·4	58·9	60·5	62·7	55·0	53·8	60·0	58·0	62·5	59·7	58·6	13b
60·0	58·6	60·5	62·1	54·5	53·7	59·1	58·0	62·5	59·6	58·3	14a
60·0	59·0	60·3	62·0	54·5	53·2	59·3	58·1	62·5	59·6	58·4	14b
60·0	59·1	60·4	62·6	55·0	53·8	60·0	58·3	62·5	59·7	58·6	15a
60·6	59·4	60·0	62·8	55·0	54·0	60·2	58·3	62·9	59·7	58·7	15b
58·2	58·5	60·5	62·1	52·6	52·0	58·0	58·0	62·4	59·2	57·6	16a
58·2	58·7	60·5	62·1	52·6	51·7	58·6	57·5	62·3	59·1	57·6	16b
60·8	59·0	59·1	62·5	55·0	54·1	59·3	58·1	62·8	59·5	58·0 <sup>4</sup> 58·7 <sup>4</sup>	{ 17a } { 17b } { 18a } { 18b }
60·3	59·1	58·8	62·5	54·5	54·3	59·1	58·1	62·8	59·4		
60·9	57·8	59·7	62·3	55·5	54·5	59·6	58·5	62·6	59·7		
60·8	57·7	59·8	62·4	56·0	54·6	59·5	58·5	62·8	59·6		
58·7	58·9	59·5	62·5	55·5	53·0	58·8	57·2	62·9	59·2	58·1	19
61·1	57·7	58·4	60·3	52·5	51·5	57·9	57·3	62·5	57·7	57·0	20
60·8	58·0	60·6	61·5	54·0	52·5	58·2	58·1	62·5	58·2	57·9	21
60·1	57·8	60·6	61·5	55·0	53·8	58·5	58·0	62·4	58·1	57·8	22

<sup>4</sup> The average given for Plots 17 is that of 12 years mineral manure succeeding ammonia-salts (Plots 17 or 18); and that given for Plots 18, of 12 years ammonia-salts succeeding the mineral manure (Plots 17 or 18).

## EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF

## APPENDIX.—TABLE XXIV.—TOTAL CORN,

Plots.	HARVESTS.										
	1844. <sup>1</sup>	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	1228	1967	1906	2031	1259	..	1220	1296	919	599	1672
1	1040	1689	1509	2119	1124	..	..	1251	825	404	1529
2	1276	1967	1826	1981	1705	2068	1861	2049	1716	1120	2675
3	923	1441	1207	1123	952	1229	1002	1083	860	359	1359
4	888	1879	1777	1780	1583	2063	1785	1919	870	446	1521
5a	956	1431	1305 1827	1921	1911	2446	1974	2473	1038	587	1578
5b											
6a	964	1871	1598 2076	2132	1932	2651	2018	2611	1065	611	1532
6b											
7a	984	1682	1400 1663	1672	2410	1960	2271	1288	978	2186	2186
7b											
8a	980	1716	1534 1834	1936	2576	2134	2524	1615	1369	2950	2950
8b											
9a	1280	2131	2163 1682	1963	2531	2112	2532	1643	1357	2944	2944
9b											
10a	1008	1842	1549 2115	1263	1481	1856	1785	1699	1346	3065	3065
10b											
11a	1116	1716	1988 2020	1267	2080	1948	1863	1651	1425	3208	3208
11b											
12a	1004	1614	1477 1755	1181	2035	1951	2142	1591	691	2456	2456
12b											
13a	1072	1942	1717	1669	1475	1762	1970	1509	649	2480	2480
13b											
14a	1016	1850	1702	1334	2141	1721	1966	1320	642	2211	2211
14b											
15a	1096	1880	1628 2044	1984	2317	2001	2216	1472	1015	2859	2859
15b											
16a	1304	2055	1941	1641	2149	1940	2163	1387	1673	2756	2756
16b											
17a	1240	1842	1660 1959	1955	2340	2027	2102	1480	1341	2913	2913
17b											
18a	1368	1558	1998 1801	1730	2346	1964	2083	1476	1396	2858	2858
18b											
19	1580	2114	1605	1944	1834	2266	2023	2120	1507	1322	2946
20	..	1495	1812	1856	1726	2123	1995	2121	1530	1347	2863
21	..	..	2112	2214	1571	2109	1693	1839	1451	1143	2801
22	..	..	1861	2140	1607	2005	1942	2077	1520	1351	2810
23	..	..	1592	1959	1973	2254	2134	2499	1794	1496	3230
24	..	..	2019	2283	1948	2268	2159	2501	1700	1537	3293
25	..	..	2241	2222	1933	2316	1985	2149	1577	520	2948
26	..	..	2034	2314	1946	2259	1961	2079	1520	539	2732
27	..	..	2048	2160	1734	2163	1934	2083	869	1111	1526
28	..	..	1474	2029	1804	2243	1845	2090	921	1256	1511
29	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..
32	..	..	..	..	..	..	..	..	..	..	..

<sup>1</sup> See foot-note No. 5, to Appendix Table I. p. 147.<sup>2</sup> For Plots 0, 1, 20, 21, and 22, the averages are for only 19, 18, 17, 13, and 13 years respectively.<sup>3</sup> On Plots 17 and 18 the manures have alternated during the last 12 years; that is, ammonia-salts on Plots 17, and the mixed mineral manure on Plots 18, in one year; mineral manure on Plots 17, and ammonia-salts on Plots 18, in the next year, and so on.



WHEAT YEAR AFTER YEAR ON THE SAME LAND.

in lbs., per Acre, per Annum.

HARVESTS.									AVERAGE.		Plots.
1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	Of 20 Years, <sup>2</sup> 1844-63.	Of last 12 Years, 1852-63.	
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1096	1179	1181	1332	1254	826	1001	1228	1429	1296	1143	0
1179	1102	1118	1055	1189	717	828	1024	1334	1169	1025	1
2237	2277	2587	2512	2263	1864	2202	2447	2886	2076	2232	2
1072	892	1236	1141	1051	738	736	996	1127	1026	964	3
1168	1026	1386	1206	1188	832	863	1049	1303	1327	1072	4
1157	1167	1409	1187	1277	903	1047	1119	1283	1422	1146	5a
1143	1247	1512	1227	1273	935	1082	1101	1296	1495	1169	5b
1753	1717	2211	1818	1808	1210	1755	1715	2522	1759	1747	6a
1811	1755	2193	1850	1855	1326	1818	1797	2534	1815	1796	6b
2084	2312	2782	2450	2097	1612	2263	2200	3477	2121	2268	7a
2138	2244	2902	2530	2089	1597	2183	2265	3507	2152	2283	7b
1909	2507	3058	2680	2068	1759	2290	2477	3668	2064	2377	8a
2153	2400	3129	2675	2007	1787	2190	2452	3559	2125	2386	8b
1932	2019	2767	2384	1806	1858	2162	2688	3576	1991	2161	9a
1605	1679	2220	1470	1412	1155	909	1641	2723	1670	1621	9b
1285	1505	1816	1439	1207	905	854	1457	2587	1547	1435	10a
1805	1727	2185	1775	1500	1060	1033	1600	2858	1655	1693	10b
1210	2001	2432	1977	1628	1270	1455	1706	2979	1860	1834	11a
1580	1946	2397	2099	1698	1307	1578	1734	3060	1875	1885	11b
1940	2102	2747	2437	2060	1648	2009	2096	3533	2064	2194	12a
2172	2079	2729	2387	2115	1577	2144	2025	3454	2065	2207	12b
1924	2036	2714	2384	2037	1575	2168	1953	3453	2032	2165	13a
2110	2008	2739	2397	2087	1600	2304	2019	3439	2049	2203	13b
1954	2195	2781	2413	2054	1583	2125	1886	3527	2042	2191	14a
2158	2162	2699	2436	2074	1563	2173	2008	3450	2043	2205	14b
2030	1923	2681	2285	2053	1510	2188	1872	3114	1989	2088	15a
2193	2045	2765	2436	2095	1614	2249	2029	3127	2053	2186	15b
2100	2426	3131	2702	2026	1856	2338	2225	3710	2239	2420	16a
2115	2450	3194	2717	2005	1889	2432	2233	3607	2284	2431	16b
1227	1983	1642	2150	1247	1409	1229	1747	1370	1761	} 1181 <sup>4</sup> {	17a
1110	1935	1583	2181	1168	1548	1166	1685	1389	1724		17b
2127	1140	2566	1472	1973	929	2050	1168	3006	1774		18a
2170	1131	2519	1338	1980	963	2122	1195	3009	1751		18b
1967	2059	2600	2177	1903	1435	2107	1479	3054	1984	2016	19
1155	1075	1213	1089	1039	722	872	818	1137	1033	989	20
1533	1398	1538	1574	1538	893	1109	1273	1796	1373	1384	21
1553	1351	1491	1412	1460	847	1306	1250	1907	1352	1362	22

<sup>4</sup> The average given for Plots 17 is that of 12 years, mineral manure succeeding ammonia-salts (Plots 17 or 18); and that given for Plots 18, of 12 years ammonia-salts succeeding the mineral manure (Plots 17 or 18).

## EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF

## APPENDIX.—TABLE XXV.—TOTAL STRAW

Plots.	HARVESTS.										
	1844. <sup>1</sup>	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	1436	3977	2561	3277	2074	..	2037	1862	1706	1807	2114
1	1203	3699	1953	3735	1735	..	..	1845	1497	1632	2531
2	1476	3915	2454	3628	3041	3029	3245	3094	3457	3372	4450
3	1120	2712	1513	1902	1712	1614	1719	1627	1597	1413	2137
4	1104	3663	2390	2948	2713	2645	3312	2949	1571	1670	2338
5a	1116	2684	{ 1541 2309 }	3412	3266	3589	4504	4131	1903	1951	2520
5b			{ 1721 2901 }								
6a	1100	3644	{ 1676 2571 }	2786	2878	3072	3927	3624	2581	2777	3845
6b			{ 3151 1968 }								
7a	1172	3243	{ 3088 3007 }	3151	3088	3584	4485	4587	3850	3741	5603
7b			{ 2953 1963 }								
8a	1160	3663	{ 3683 2575 }	2317	1815	3407	2769	3806	3966	6135	6117
8b			{ 3720 2148 }								
9a	1368	4058	{ 2506 3052 }	2033	1945	2683	3550	3252	3714	2399	4142
9b			{ 2858 2603 }								
10a	1112	4266	{ 2244 1455 }	2891	2367	2851	3089	3070	2787	2049	3597
10b			{ 2874 2133 }								
11a	1200	4104	{ 3274 2715 }	3517	3274	2892	3806	3386	3081	2524	5147
11b			{ 3203 2163 }								
12a	1116	4134	{ 3390 2554 }	3452	3390	3371	3921	3600	3257	3665	5503
12b			{ 3124 2327 }								
13a	1204	3355	{ 3306 2755 }	3306	3290	3236	4026	3544	3222	3704	5398
13b			{ 3171 2031 }								
14a	1176	3696	{ 3257 2534 }	3362	3257	3211	4052	3605	3547	3471	5552
14b			{ 3006 2897 }								
15a	1240	4044	{ 3876 2513 }	2937	3038	3321	3041	3212	3361	4898	5273
15b			{ 3617 2836 }								
16a	1480	4191	{ 3115 2836 }	3417	3115	3384	5103	4234	4677	4904	6702
16b			{ 3559 2067 }								
17a	1422	3826	{ 3296 2784 }	4027	3296	3891	4126	3597	3734	1996	5270
17b			{ 3858 2838 }								
18a	1768	3819	{ 3592 1893 }	3852	2935	3592	3927	3390	1687	3385	2418
18b			{ 3779 4164 }								
19	1772	4215	2425	4202	3295	3270	3527	3348	3397	3213	4677
20	..	3104	..	2074	1721	..	1639	1609	1577	1659	2217
21	..	..	..	..	..	..	..	..	2108	2181	3440
22	..	..	..	..	..	..	..	..	2179	1860	3340

<sup>1</sup> See foot-note No. 5, to Appendix Table I. p. 147.<sup>2</sup> For Plots 0, 1, 20, 21, and 22 the averages are for only 19, 18, 17, 13, and 13 years respectively.<sup>3</sup> On Plots 17 and 18 the manures have alternated during the last 12 years; that is, ammonia-salts on Plots 17, and the mixed mineral manure on Plots 18, in one year; mineral manure on Plots 17, and ammonia-salts on Plots 18, in the next year, and so on.

## WHEAT YEAR AFTER YEAR ON THE SAME LAND.

(and CHAFF), in lbs., per Acre, per Annum.

HARVESTS.									AVERAGE.		Plots.	
1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	Of 20 Years, <sup>2</sup> 1844-63.	Of last 12 Years, 1852-63.		
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
1726	1969	1545	1902	2310	1445	1768	2030	1825	2072	1846	0	
1890	1933	1532	1630	2300	1380	1387	1748	1745	1965	1767	1	
3845	4317	3323	3837	4810	3440	3101	4195	4279	3515	3869	2	
1787	1558	1577	1670	2175	1459	1254	1713	1600	1693	1662	3	
1832	1731	1572	1673	2230	1520	1330	1662	1654	2125	1732	4	
1819	2012	1617	1532	2323	1580	1493	1840	1687	2345	1856	5a	
1800	2122	1735	1643	2393	1660	1610	1860	1768	2501	1938	5b	
2837	3050	2757	2577	3747	2183	2573	2839	3714	2909	2957	6a	
3037	3093	2757	2713	3853	2393	2683	3100	3716	3044	3067	6b	
3911	4560	3680	3965	4677	3003	3501	3906	5853	3776	4187	7a	
4156	4398	3891	4092	4803	3137	3555	3913	5878	3830	4236	7b	
3838	5182	4297	4667	5353	3880	3913	4723	6715	3862	4706	8a	
4342	5089	4450	4667	5597	3813	3795	4635	6489	3977	4725	8b	
3946	3875	3867	4317	5270	4777	4445	6050	6312	3739	4426	9a	
3212	3152	2983	2688	3590	3130	2170	3256	4197	2998	3187	9b	
2512	2818	2392	2130	2730	2213	1930	2593	3481	2656	2603	10a	
3268	3168	2875	2615	3420	2360	2163	2843	4056	2866	3061	10b	
2434	3517	2943	2797	3527	2503	2577	2842	4233	3124	3181	11a	
3153	3443	2920	3018	3577	2693	2645	2873	4459	3176	3285	11b	
3538	3847	3647	3663	4550	3230	3192	3649	5443	3617	3932	12a	
4010	3725	3583	3673	4743	3087	3337	3609	5365	3607	3962	12b	
3503	3743	3707	3693	4737	2993	3318	3589	5739	3582	3945	13a	
3870	3651	3647	3677	4807	3037	3490	3672	5799	3632	4033	13b	
3577	4202	3658	3737	4763	3053	3377	3397	5459	3609	3983	14a	
4003	4117	3652	3710	4700	3103	3303	3550	5299	3615	4019	14b	
3825	3521	3687	3515	4773	2877	3318	3396	5162	3499	3795	15a	
4222	3752	3778	3698	4993	3090	3478	3758	5113	3669	4028	15b	
4534	5529	4683	4797	5927	4117	4423	4527	7007	4441	5152	16a	
4991	5467	4703	4813	5793	4207	4343	4497	6725	4511	5151	16b	
1976	3558	2058	3203	2483	2700	1753	3080	1918	3060	1985 <sup>4</sup>	{ 17a } <sup>3</sup>	
1804	3465	1940	3274	2373	2970	1663	3077	1903	2988			3755 <sup>4</sup>
4017	2012	3443	2008	4533	1720	3094	1993	4883	3065			
4215	1938	3365	1967	4650	1743	3324	2140	4728	3096			
3851	3562	3193	3185	4023	2743	3238	2653	4523	3416	3521	19	
1831	1888	1564	1730	2217	1433	1468	1517	1472	1807	1714	20	
2419	2529	1815	2373	3185	1746	1640	2192	2483	2298	2343	21	
2457	2498	1807	2180	2980	1567	1957	2180	2692	2266	2308	22	

<sup>4</sup> The average given for Plots 17 is that of 12 years mineral manure succeeding ammonia-salts (Plots 17 or 18); and that given for Plots 18, of 12 years ammonia-salts succeeding the mineral manure (Plots 17 or 18).



EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF  
APPENDIX.—TABLE XXVI.—TOTAL PRODUCE

Plots.	HARVESTS.										
	1844. <sup>1</sup>	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0	2664	5944	4467	5308	3333	..	3257	3158	2625	2406	3786
1	2243	5388	3462	5854	2859	..	..	3096	2322	2036	4060
2	2752	5882	4280	5609	4746	5097	5106	5143	5173	4492	7125
3	2043	4153	2720	3025	2664	2843	2721	2710	2457	1772	3496
4	1992	5542	4167	4728	4296	4708	5097	4868	2441	2116	3859
5a	2072	4115	{ 2846 4136	5333	5177	6035	6478	6604	2941	2538	4098
5b			{ 3319 4977								
6a	2064	5515	{ 3076 4538	4449	4550	5482	5887	5895	3869	3755	6031
6b			{ 4435 3502								
7a	2156	4925	{ 4985 5170	4985	5024	6160	6619	7111	5465	5110	8553
7b			{ 5376 3512								
8a	2140	5379	{ 5798 4563	5798	3580	3296	5263	4554	5505	5312	9200
8b			{ 5740 3415								
9a	2648	6189	{ 3983 4807	3126	4718	5501	5394	5305	3090	6598	6598
9b			{ 4545 4575								
10a	2120	6246	{ 4094 2671	4593	3701	4992	4810	5036	4107	2691	5808
10b			{ 4579 3761								
11a	2316	5984	{ 5561 4770	5258	5209	5807	5602	4553	3539	8006	8006
11b			{ 5144 3824								
12a	2120	5976	{ 5405 4509	5328	5767	5856	5834	4760	4948	8469	8469
12b			{ 4920 3987								
13a	2276	4913	{ 4972 4753	4802	5592	5972	5523	4765	5308	8403	8403
13b			{ 5306 3636								
14a	2192	5439	{ 5091 4346	5091	5477	6075	5725	5054	4793	8498	8498
14b			{ 4862 4623								
15a	2336	6147	{ 6090 4374	4508	5147	5014	4880	4663	4504	7699	7699
15b			{ 5757 4623								
16a	2784	6219	{ 5376 4855	5088	5638	7237	6733	6471	6400	9932	9932
16b			{ 6295 4855								
17a	2662	5919	{ 6249 4818	5229	6207	6111	5746	5311	2516	8218	8218
17b			{ 6575 4886								
18a	3136	5867	{ 6012 3367	4669	5755	5861	5473	2556	4496	3944	3944
18b			{ 6193 3367								
19	3352	6329	4314	6397	5133	5264	5377	5379	4979	4373	7343
20	..	4599	..	3406	2771	..	2507	2565	2452	2084	3662
21	..	..	..	..	..	..	..	2995	3285	2934	5470
22	..	..	..	..	..	..	..	2995	3355	2452	5334

<sup>1</sup> See foot-note No. 5, to Appendix Table I. p. 147.<sup>2</sup> For Plots 0, 1, 20, 21, and 22, the averages are for only 19, 18, 17, 13, and 13 years respectively.<sup>3</sup> On Plots 17 and 18 the manures have alternated during the last 12 years; that is, ammonia-salts on Plots 17, and the mixed mineral manure on Plots 18, in one year; mineral manure on Plots 17, and ammonia-salts on Plots 18, in the next year, and so on.



## WHEAT YEAR AFTER YEAR ON THE SAME LAND.

(CORN and STRAW), in lbs., per Acre, per Annum.

HARVESTS.									AVERAGE.		Plots.			
1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	Of 20 Years, <sup>2</sup> 1844-63.	Of last 12 Years, 1852-63.				
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.				
2822	3148	2726	3234	3564	2271	2769	3258	3,254	3368	2989	0			
3069	3035	2650	2685	3489	2097	2215	2772	3,079	3134	2792	1			
6082	6594	5910	6349	7073	5304	5303	6642	7,165	5591	6101	2			
2859	2450	2813	2811	3226	2197	1990	2709	2,727	2719	2626	3			
3000	2757	2958	2879	3418	2352	2193	2711	2,957	3452	2804	4			
2976	3179	3026	2719	3600	2483	2540	2959	2,970	3767	3002	5a			
2943	3369	3247	2870	3666	2595	2692	2961	3,064	3996	3107	5b			
4590	4767	4968	4395	5555	3393	4328	4554	6,236	4668	4704	6a			
4848	4848	4950	4563	5708	3719	4501	4897	6,250	4859	4863	6b			
5995	6872	6462	6415	6774	4615	5764	6106	9,336	5897	6455	7a			
6296	6642	6793	6622	6892	4734	5738	6178	9,385	5982	6519	7b			
5747	7689	7355	7347	7421	5639	6203	7200	10,383	5926	7083	8a			
6495	7489	7579	7342	7604	5600	5985	7087	10,048	6102	7111	8b			
5878	5894	6634	6701	7076	6635	6607	8738	9,888	5730	6587	9a			
4817	4831	5203	4158	5002	4285	3079	4897	6,920	4668	4808	9b			
3797	4323	4208	3569	3937	3118	2784	4050	6,068	4203	4038	10a			
5073	4895	5060	4390	4920	3420	3196	4443	6,914	4521	4754	10b			
3694	5518	5375	4774	5155	3773	4032	4548	7,212	4984	5015	11a			
4733	5389	5317	5117	5275	4000	4223	4607	7,519	5051	5170	11b			
5478	5949	6394	6100	6610	4878	5201	5745	8,976	5681	6126	12a			
6182	5804	6312	6060	6858	4664	5481	5634	8,819	5672	6169	12b			
5427	5779	6421	6077	6774	4568	5486	5542	9,192	5614	6110	13a			
5980	5659	6386	6074	6894	4637	5794	5691	9,238	5681	6236	13b			
5531	6397	6439	6150	6817	4636	5502	5283	8,986	5651	6174	14a			
6161	6279	6351	6146	6774	4666	5476	5558	8,749	5658	6224	14b			
5855	5444	6368	5800	6826	4387	5506	5268	8,276	5488	5883	15a			
6415	5797	6543	6134	7088	4704	5727	5787	8,240	5722	6214	15b			
6634	7955	7814	7499	7953	5973	6761	6752	10,717	6680	7572	16a			
7106	7917	7897	7530	7798	6096	6775	6730	10,332	6795	7582	16b			
3203	5541	3700	5353	3730	4109	2982	4827	3,288	4821	3166 <sup>4</sup>	{17a}			
2914	5400	3523	5455	3541	4518	2829	4762	3,292	4712			5809 <sup>4</sup>	{17b}	
6144	3152	6009	3480	6506	2649	5144	3161	7,889	4839					{18a}
6385	3069	5884	3305	6630	2706	5446	3335	7,737	4847					
5818	5621	5793	5362	5926	4178	5345	4132	7,577	5400	5537	19			
2986	2963	2777	2819	3256	2155	2340	2335	2,609	2840	2703	20			
3952	3927	3353	3947	4723	2639	2749	3465	4,279	3671	3727	21			
4010	3849	3298	3592	4440	2414	3263	3430	4,599	3618	3670	22			

<sup>4</sup> The average given for Plots 17 is that of 12 years mineral manure succeeding ammonia-salts (Plots 17 or 18); and that given for Plots 18, of 12 years ammonia-salts succeeding the mineral manure (Plots 17 or 18).

VI.—*On Peruvian Guano and the Means of Increasing its Efficacy as a Manure.* By DR. AUGUSTUS VOELCKER.

PERUVIAN guano, like well-made farmyard-manure, has been found to benefit more or less all kinds of crops grown on every description of land. For this reason it is considered a more universal fertiliser than artificial manures, which, like nitrate of soda, wool-refuse, horn-shavings, &c., exercise a beneficial action upon vegetation solely in virtue of their nitrogen, and consequently should only be used in special cases and with great discrimination, especially on soils deficient in the mineral substances found in the ashes of plants.

With the exception of a trifling quantity of sand, seldom exceeding 2 per cent., and 12 to 15 per cent. of moisture, genuine Peruvian guano contains nothing which is not of great utility to vegetation.

We find, indeed, in it in a concentrated state the most valuable fertilising constituents, and do not meet in it with substances which, though necessary to a healthy growth of plants, are abundantly distributed throughout most soils, and therefore may well be dispensed with in a concentrated manure.

But although it contains potash, soda, chloride of sodium, lime, magnesia, oxide of iron, phosphoric acid, sulphuric acid, and silica, or nearly all the ash-constituents of plants, the large amount of ammoniacal salts and nitrogenous organic matter which enter into it chiefly determine its commercial and agricultural value.

Ammoniacal salts and nitrogenous matters possess a money-value which is, in a great measure, independent of the demand of the agriculturist for these materials. Guano, when cheap, may and has been used as the raw material for the manufacture of spirits of hartshorn, carbonate and sulphate of ammonia, as also for preparing Prussian-blue, murexide-purple, and other dyes, and such competition would disturb, and possibly might injure, the market for the farmer.

In my own mind I have no doubt that Peruvian guano is worth more to the agriculturist and the dealer in artificial manures than to other chemical manufacturers, because its constitution is one that gives it special value as food for plants; as a source of nitrogen, it differs materially from wool-refuse (shoddy), (which being impregnated with oil dissolves but slowly in the soil, and is therefore far less valuable,) and resembles a quick acting because rapidly decomposing material, such as blood or fish-refuse.

Genuine Peruvian guano contains from 6 to 7 per cent. of ready-formed ammonia, and an amount of nitrogenous organic constituents which on decomposition yield about 12 per cent.

of ammonia. The phosphates which guano contains—bone-earth in a finely divided state to the extent of 22 to 24 per cent.—as well as its soluble alkaline phosphates, are presented in a very valuable shape. Its alkalis, specially the potash, will much benefit crops on light soils, which are generally deficient in this element.

As long as Peruvian guano was sold at a price which left a broad margin for profit, many farmers did not trouble themselves to enquire whether they derived the utmost advantage from its application, or whether they did not incur a partial waste by applying it to crops or upon soils for which other fertilisers were better suited. But a gradual rise in price compelled them to study greater economy in its use, and to try experiments with a view of ascertaining when, and in what quantities, for what crops, and upon what soils, it should be used.

The successful employment of superphosphate and similar artificial manures, prepared more particularly for root-crops, has at the same time very much tended to enlarge our experience and knowledge on the relative merits of phosphatic and ammoniacal fertilisers. The high price of guano for the moment aided the introduction of superphosphate, and gave greater range and precision to this branch of agricultural science.

The true interests of the importers of guano and the manufacturers of manures are not opposed to each other; for Peruvian guano, judiciously used for special purposes, can well compete with other artificial manures; and for other purposes a much cheaper manure may often be used with greater advantage in preference to guano.

It appears desirable that Peruvian guano, as hitherto, should be sold genuine by the recognised agents of the sole importers; and the supervision which the importers exercise in appointing respectable agents, and the care they take to prevent the adulteration of guano, deserve all praise. If, however, it can be shown that the efficacy of Peruvian guano may be greatly increased by certain chemical and mechanical means, requiring more time and attention than the farmer is likely to bestow upon it; and that the admixture of other fertilising matters renders guano more useful in many cases, it must surely be an advantage to the importers to give fitting opportunity for its being so treated and combined.

If it were true that the proportion of nitrogen in the organic matters and of ammoniacal salts in manures solely determined their efficacy and value, in reference to all crops, in all climates, and on every description of soil, Peruvian guano, perhaps, would be pre-eminently the most valuable artificial manure. We know, however, very well that this large supply of nitrogen is, in some cases, of no use whatever, and in others exercises a decidedly in-

jurious effect. There are clay soils in Gloucestershire, Herefordshire, and other counties, on which the application of ammoniacal salts to root-crops often diminishes the crop, and, at the best, is of no benefit whatever to the swedes or turnips. Again, on light sandy soils, although for a time highly nitrogenous manures may largely increase the yield of corn, yet their exclusive and long continued use leads to a rapid exhaustion of the soil in those mineral constituents of which an abundant supply is required by all cultivated plants. On the other hand, there are certain loamy soils on which Peruvian guano is used with great advantage for grass and corn crops, especially as a top-dressing for wheat and barley; and the only question which arises is, whether the required nitrogen is more economically applied to the land in that shape, than as nitrate of soda, sulphate of ammonia, soot, &c.

### *Preparation of Guano.*

When guano is used as a top-dressing, or is drilled in, more care should be taken than is frequently bestowed to apply it in a good mechanical condition. It should never be sown without having been submitted to the rather tedious and unpleasant process of sifting and grinding into a fine powder. The hard lumps, varying from the size of a pea to that of an egg, which always occur in good Peruvian guano, do not materially differ in composition from the finer particles, and should be reduced to as fine a powder as the rest.

If guano is sown without such preparation, the fine dust will be carried away too readily by the wind, and the coarser portions will fall too much together in one place. In consequence of this unequal distribution, the young plants will be burned up where the lumps drop, near-by there will be a rank growth, and the crop will ripen unequally. The danger arising from unequal distribution is less when the manure is applied to the land in autumn before sowing the seed-corn. This practice should be adopted in all cases in which the soil contains a fair amount of clay, which, in virtue of its well-known absorbing properties, retains the fertilizing constituents of guano, so that the rain falling upon the land during the winter months, instead of removing the most valuable manuring substances, as in the case of light sandy soils, has the advantage of disseminating them uniformly through the soil.

### *Mechanical Preparation of Guano.*

It has been recommended to sift the guano, to spread the lumps retained by the sieve on a clean stone-floor, and to pass a garden-roller over them, or to beat them down with the back of a shovel



or a turf-beater. It is extremely difficult, however, by these means to reduce them to a sufficiently fine powder. Even grinding under a millstone does not answer the purpose, for guano is very apt to cake under the stone. It therefore requires to be mixed with some material which counteracts this tendency to cake. Gypsum, fine ashes, salt, charcoal-dust, and dry soil, are some of the materials that have been recommended. Gypsum, however, does not prevent the caking; it therefore is ill suited for the purpose. Salt likewise is objectionable; for it gives the guano a moist appearance, and rather increases than diminishes the difficulty. Finely-sifted coal or wood ashes, charcoal-dust, and dry soil, answer better; but perhaps the best material for effecting the reduction of guano to a fine powder is sharp sand.

The proper way of proceeding is first to sift off all the fine guano-dust, then to mix the hard lumps left in the sieve with about twice their bulk of sand, to spread the mixture on an even floor, and to pass a heavy roller over it, or to beat down the lumps with a wooden mallet. The admixture of sand prevents the caking of the guano, and greatly facilitates its reduction to fine powder. After the whole has gone through the sieve, salt in the proportion of two parts by weight to one of guano may be added with great advantage. The moisture imparted to the guano by the salt prevents the dusting, which is so great an inconvenience in sowing it by hand. Salt in conjunction with guano, moreover, has a specific action on vegetation, which is specially beneficial to corn-crops on light soils.

### *Analyses of Guano.*

Notwithstanding that many elaborate and careful analyses have been made, some peculiarities in the chemical constitution of Peruvian guano have been passed by either unnoticed or have not attracted the degree of attention to which they are entitled. In order to render more intelligible in what these peculiarities consist, and how far they affect our endeavours to render guano more efficacious, I would invite attention to the following analyses of three samples of Peruvian guano of this year's importation.

#### *Composition of Three Samples of Peruvian Guano.*

Moisture .. .. .	18.42	15.14	16.56
*Organic matters and salts of ammonia .. ..	52.11	52.81	51.70
Phosphates of lime and magnesia (bone-earth)	21.99	20.26	23.55
†Alkaline salts .. .. .	6.37	10.52	6.44
Insoluble siliceous matters (sand) .. ..	1.11	1.27	1.75
	<hr/>	<hr/>	<hr/>
	100.00	100.00	100.00
*Containing nitrogen .. .. .	15.34	15.41	15.13
Equal to ammonia .. .. .	18.62	18.69	18.37
†Containing phosphoric acid .. .. .	2.23	2.48	1.08
Equal to bone-earth .. .. .	4.83	5.36	2.34

*Organic Matter and Salts of Ammonia.*—For all practical purposes it is quite sufficient to determine together organic matters and ammoniacal salts, and to indicate how much ammonia will be produced by 100 parts of guano on its final decomposition in the soil.

The salts of ammonia, as well as the organic matters, include several distinct chemical compounds. Phosphate, sulphate, oxalate, urate, and carbonate of ammonia are constantly present in Peruvian guano; but the relative proportion of these salts varies to a considerable extent in different samples. The organic matter includes uric acid, a little urea, oxalic acid, guanine, and other nitrogenised substances, and also butyric, phocenic, and similar fatty acids, to which the peculiar and characteristic smell of guano is principally due. With the exception of the fatty acids, all these organic substances are rich in nitrogen, and very prone to suffer decomposition in the presence of water. The most important product of their decomposition is ammonia. The strong and pungent smell of guano damaged by sea-water is due to ammonia, and indicates a partial decomposition which the nitrogenous organic matters have sustained. Such a decomposition does not take place without loss of ammonia. Hence dark-coloured and pungent-smelling samples are generally poorer in nitrogen, and less valuable than those which are light-coloured, dry, and far less pungent. Uric acid and urate of ammonia, which are nearly insoluble in water, contain fully one-third of their weight of nitrogen. As long as guano is kept in a dry atmosphere, the nitrogen in these compounds remains in a fixed condition. Under the influence of oxygen and a certain temperature, uric acid in the presence of water passes through a very remarkable series of transformations, producing allantoin, urea, and oxalic acid. Urea in its turn is readily resolved into carbonate of ammonia. These changes in the nitrogenised constituents proceed rapidly when guano is incorporated with a moist soil. It cannot, therefore, be doubted that the nitrogenous matters of guano, in virtue of the ammonia they produce, are as useful to vegetation as the actual ammonia which occurs in it in the shape of ammoniacal salts. For all practical purposes, therefore, the distinction between actual ammonia and potential ammonia\* is of little significance, and the same money-value which is given to the actual ammonia may with propriety be assigned to the ammonia which guano is capable of yielding on decomposition.

*Oxalic acid*, it will be noticed, is a product of decomposition of uric acid, and therefore is always present in damaged guano

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\* That is to say, the ammonia which nitrogenous matters are capable of evolving gradually in the soil.

in greater abundance than in dry and sound samples. In good samples, which have an aromatic rather than pungent smell, I find invariably a large proportion of uric and little oxalic acid, and in inferior, dark, strong-smelling damaged samples, comparatively speaking, little uric and much oxalic acid; therefore a large amount of oxalic acid in guano indicates inferior quality. The oxalic acid, however, as we shall see hereafter, plays an important part in rendering the insoluble phosphatic constituents soluble.

### *Ready-formed Ammonia in Guano.*

In a scientific point of view, the determination of ready-formed ammonia in guano is of some interest. In a practical point of view, it likewise appeared to me desirable to ascertain whether or not guano contains any free or, more properly speaking, volatile carbonate of ammonia. I therefore determined in the preceding samples both the amount of free ammonia and that present in the shape of ammoniacal salts.

For this purpose 100 grains of each sample were introduced into a glass retort, and mixed with 4 ozs. of distilled water. The retort was connected air-tight with a glass receiver, to which was attached the bulb apparatus, used in nitrogen combustion. Both the glass receiver and bulb apparatus contained a measured quantity of sulphuric acid of known strength for the reception of the ammonia given off during the process of distillation. The contents of the retort were nearly distilled to dryness, and by this means the free or volatile carbonate of ammonia was distilled over with water only, and received into sulphuric acid. It is hardly necessary to observe that a portion of the acid becomes neutralised by the ammonia, and that by employing a fixed quantity of sulphuric acid, and a standard solution of caustic soda, the exact amount of ammonia given off during the distillation can be readily determined by the well known alkali-metrical process.

The result was that the 3 samples furnished:—

	No. 1.	No. 2.	No. 3.
Ammonia .. .. .	1·13	1·31	1·32

It thus appears that the proportion of free ammonia in these 3 samples of good Peruvian guano was little above 1 per cent. The preceding figures express the amount of caustic or free ammonia contained in the vapours that were received in the acid during the process of distillation. Guano, however, like all other putrefying nitrogenous substances, does not furnish ammonia free or caustic, but as a carbonate; this carbonate is often in common life miscalled free ammonia, in consequence of its being volatile and having the same smell.

In order to determine the amount of ammonia existing in the shape of urate, sulphate, and other salts, the residue from which the volatile carbonate of ammonia was distilled off with water, was mixed with quick lime, some caustic soda, and a fresh quantity of distilled water, and after the acid in the receiver and bulb apparatus had been renewed, the contents of the retort were distilled nearly to dryness.

The following were the results obtained :—

	No. 1.	No. 2.	No. 3.]
Percentage of ammonia present as salts of } ammonia .. .. . }	5.41	5.53	4.91

Adding the ammonia which occurred in these samples as volatile carbonate to that existing in the shape of non-volatile salts, we get in the first sample 6.54, in the second 6.84, and in the third 6.23 per cent. of ready-formed or actual ammonia; and as the total amount of ammonia to be furnished on ultimate decomposition amounted to  $18\frac{1}{2}$  per cent. in round numbers, it will be seen that in good samples one-third of the total amount of ammonia which guano is capable of yielding is actual, and two-thirds potential ammonia, or, more correctly speaking, one-third of the nitrogen exists in ready-formed ammonia, and two-thirds in the form of uric acid, guanine, and other organic matters which readily yield ammonia on decomposition.

The proportions of volatile and of fixed but ready-formed ammonia vary considerably in different samples.

In dry and first-rate samples the ready-formed ammonia seldom exceeds  $6\frac{1}{2}$  to 7 per cent.; the ammonia in a volatile condition usually amounts to  $\frac{1}{2}$  or  $\frac{3}{4}$  per cent. In wet or damaged samples, on the other hand, the proportion both of volatile ammonia and of ready-formed but fixed ammoniacal salts is more considerable. The following determination indicates this difference.

#### Percentage of free Ammonia in—

1. A dry good sample	.. .. .	5.73
2. Ditto	.. .. .	5.84
3. Ditto	.. .. .	1.309
4. Ditto	.. .. .	1.474
5. Damaged guano	.. .. .	1.891
6. Ditto	.. .. .	1.820
7. Ditto	.. .. .	2.748

There was but little of a pungent smell in the 4 good samples; the 3 damaged specimens had a strong smell of ammonia. In No. 7 the amount of fixed ammonia was 9.944 per cent., which is considerably more than is found in some good guano. It follows from these remarks that a powerful pungent smell, to a certain extent indicates inferior quality.



*The Solubility of Phosphates in Guano.*

Genuine Peruvian guano contains from 22 to 24 per cent. of earthy phosphates; but since the action of rain or other deteriorating influences removes the soluble constituents, the proportion of insoluble or earthy phosphates is larger in inferior samples.

The earthy phosphates occur in guano in a finely divided condition, in which they are no doubt more valuable than they would be in the shape of a coarse powder; but several direct determinations have shown me that they are not more soluble than good bone-dust.

In two experiments which I made, I found that 1 gallon of water dissolved respectively 2.46 and 2.64 grains of phosphate of lime.

In addition to insoluble phosphate of lime and magnesia (bone-earth), guano, it will be seen by the preceding analyses, contains soluble phosphoric acid in considerable though varying quantities. The soluble phosphoric acid occurs naturally as phosphate of ammonia, which, according to the usual way of performing an analysis, is classed with the alkaline salts. As this phosphoric acid is a most valuable constituent, it ought always to be determined when it is desired to ascertain correctly the money-value of guano. On an average I find in Peruvian guano a quantity of soluble phosphoric acid, which corresponds to 5 to 6 per cent. of bone-earth.

*Alkaline Salts.*—In considering the value of Peruvian guano, the fact that it contains potash ought not to be overlooked.

On an average good samples contain from 6 to 8 per cent. of alkaline salts, and, according to Professor Way, nearly one half of their weight consists of potash.

This constituent may contribute a good deal to its value as a manure for root-crops grown on light land deficient in potash.

*Salt does not fix Ammonia.*

Various means of increasing the efficacy of guano have been from time to time recommended, amongst others the addition of salt; and there can be no doubt of the propriety of such an admixture. The grounds on which its recommendation was based are, however, mistaken, because the beneficial effect certainly does not arise from any power which salt is supposed to possess of fixing the ammonia. Any one, who possesses even a slight acquaintance with chemistry may readily ascertain experimentally the amount of free ammonia contained in solutions or dry substances, and may satisfy himself that free ammonia is neither increased nor diminished by the addition of salt in small or large quantities. It is strange how generally the opinion has

been received which ascribes to salt this power. The explanation of this mistaken notion no doubt lies in the fact that salt is an excellent antiseptic, and consequently prevents the further decomposition of nitrogenous organic matters, and with it the further formation of ammonia, but it does not fix any existing free ammonia. Free ammonia in a substance soon escapes, and since, by the use of salt, further decomposition is effectually stopped, and the pungent smell which accompanies it is no longer perceptible, it is easy to conceive how salt should have received credit for being a fixer of ammonia.

In proof of the supposed value of common salt as a fixer of ammonia the following experiments of M. Barral, editor of the "*Journal d'Agriculture Pratique*," are quoted:—M. Barral took samples of guano; the one he kept pure, the other he mixed with an equal weight of common salt. The sample of pure guano was found on analysis to contain 12·56 per cent. of nitrogen; the sample mixed with salt contained 6·23 per cent., or as nearly as possible half the quantity of nitrogen. Equal weights of the two samples were exposed to heat for three hours in the same stove, in a current of air, maintained at 212° Fahr. They were spread out so as to have the same thickness, and occupy an equal surface, and they had been equally pulverised. At the end of three hours, on examining the two samples, the pure guano had lost 5·1 per cent. of its nitrogen, while the mixture had lost only 1·9 per cent.

This experiment, which appeared to be in favour of the preservative power of salt, was repeated under another form. Equal weights of the pure and the mixed guano were left in the open air, in plates, during fifteen days. At the end of that time the amount of nitrogen was determined in each sample, and it was found that the pure guano had lost 11·6 per cent. of its nitrogen, while that mixed with salt had lost only 5 per cent. Independent of the influence of salt in these experiments is the important fact that in this case upwards of one-tenth of the nitrogen was lost in the course of fifteen days. It will be observed that the guano here used contained only 12·56 per cent. of nitrogen, that is, a quantity much smaller than occurs in genuine sound Peruvian guano. It appears to me, therefore, likely that the guano was not of the best description, but probably a sample in an actual state of decomposition. Such samples yield ammonia constantly as a product of decomposition of the nitrogenous matters, and the addition of salt had not the effect of fixing any free ammonia, but by checking decomposition, it prevented the further formation and loss of ammonia. The correctness of this view appears clearly from the following experiments, which I made in the hope of confirming M. Barral's observations.

A sample of good Peruvian guano, which furnished a quantity of nitrogen corresponding to 17·24 per cent. of ammonia, and contained 12·82 per cent. of moisture, was dried in a current of hot air for three hours at a temperature of 212° Fahr. The ammonia driven off with the watery vapours was carefully collected in a bulb-apparatus containing hydrochloric acid, and the amount determined in the usual way with bi-chloride of platinum. At the end of 3 hours it was found to have lost ·75 per cent. of ammonia.

A second sample of the same guano was mixed with an equal weight of common salt, and submitted to the same process. The mixture contained 11·20 of moisture, and furnished on combustion with soda-lime 8·73 per cent. of ammonia, or as nearly as possible half the quantity which was found in the pure guano. At the end of 3 hours' drying in a current of air at 212°, the loss in ammonia was determined and found to amount to ·40 per cent.

The pure guano, it will be seen, lost no more ammonia than the sample mixed with 50 per cent. of salt.

Dried at 212° Fahr., the pure guano furnished altogether 19·77 per cent. of ammonia, and the mixed sample 9·83 per cent.

Equal weights of the pure and mixed guano were now exposed to the open air, in plates, during one month. At the end of that time the percentage of moisture, free ammonia, and total amount of nitrogen, calculated as ammonia, were determined in precisely the same way as before. The pure guano then contained 17·65 per cent. of moisture, ·69 of free ammonia, and on combustion with soda-lime furnished altogether 16·30 of ammonia. The mixture of equal parts of salt and guano after a month's exposure to air contained 19·69 per cent. of moisture, ·31 of free ammonia, and yielded altogether 7·94 per cent. of ammonia. Calculated in a perfectly dry state, the pure guano produced 19·73 of ammonia, and the mixed sample 9·88, or almost exactly the same quantities which both samples yielded before exposure to the air.

Notwithstanding the absorption of moisture during a month, neither the pure nor the mixed guano lost any ammonia. The absorption of moisture by the pure guano, it will be remarked, amounted to nearly 5 per cent., and that by the mixed sample to 7 per cent.

These results, arranged for the sake of greater perspicuity in the following tabular form, show at a glance that genuine Peruvian guano loses but an insignificant proportion ( $\frac{3}{4}$  per cent.) of ammonia by long exposure to air at the ordinary temperature, or by drying in a current of air of the temperature of boiling water, and that therefore salt did not in these experiments exercise any chemical action.

## Guano and Salt Experiments.

	Before exposure to Air.		After exposure to Air for 1 Month.	
	Pure Guano.	50 per Cent. of Guano, and 50 per Cent. of Common Salt.	Pure Guano.	50 per Cent. of Guano, and 50 per Cent. of Common Salt.
Percentage of moisture .. .. .	12·82	11·20	17·65	19·69
Percentage of ammonia driven off with moisture at 212° Fahr. .. }	·75	·40	·69	·31
Percentage of total amount of nitrogen of the guano in natural state }	14·19	7·19	13·42	6·54
Equal to ammonia .. .. .	17·24	8·73	16·30	7·94
Percentage of total amount of nitrogen calculated for substance, dried at 212° Fahr. .. .. . }	16·28	8·10	16·25	8·14
Equal to ammonia .. .. .	19·77	9·83	19·73	9·88

The same guano which was used in the preceding experiments was kept for a period of more than a year, and then analysed; it then yielded the following results:—

Moisture .. .. .	16·593
*Organic matter and ammoniacal salts .. .. .	52·311
Phosphates of lime and magnesia (bone-earth) .. .. .	22·273
Alkaline salts .. .. .	7·380
Insoluble siliceous matter (sand) .. .. .	1·443

100·000

*Containing nitrogen .. .. .	13·60
Equal to ammonia .. .. .	16·52
Percentage of nitrogen in perfectly dried guano .. .. .	15·90
Equal to ammonia .. .. .	19·31

It will be seen that even in so long a period the guano scarcely lost any ammonia; the total amount of nitrogen in the dried guano was 16·28 per cent. in the preceding year; now it is 15·90 per cent. The difference between the two determinations—·38 per cent.—is so small that it might fairly be regarded as a variation, which may occur in any two separate analyses of the same material.

It follows unmistakably from these experiments that good Peruvian guano may be kept for any reasonable length of time in a dry place (such as a dry shed), without losing any of its fertilizing properties, and that there is no need of resorting to chemical substances which are known to possess the property of fixing ammonia. The recommendation to cover up or mix it immediately after its delivery with some fixer or preserver of ammonia, therefore, possesses no practical value.



*Damaged Guano.*

The case is different with damaged or wet guano. Such guano is generally in an active state of decomposition, and loses the more ammonia the longer it is kept. When good guano is moistened with water, it enters into an active fermentation in less than 24 hours, in consequence of which it rapidly loses ammonia. Care, therefore, should be taken not to expose guano to rain, and not to store it away on a damp floor or in an exposed shed.

The peculiar smell of dry Peruvian guano, it has been observed already, is caused by a number of fatty acids derived from the fish-oil of the food of the guano-birds. There are, however, many persons who, on noticing the more or less powerful smell emanating from guano, farmyard manure, compost-heaps, and similar matters, have an indiscriminate apprehension of a loss of ammonia. In an active state of putrefaction refuse matters of that kind certainly give off ammonia, but when the process of putrefaction is effectually arrested by desiccation, the further evolution of ammonia ceases, and the disagreeable smell of the refuse matter, though not so pungent as before, still remains sufficiently unaltered to show that animal matters may smell strongly and yet not lose any ammonia.

If any one doubts the truth of this assertion, let him drench a couple of ounces of Peruvian guano completely with dilute sulphuric acid, and he will find that the characteristic smell of the guano is not removed or weakened by the acid. If the smell were due to ammonia, the excess of acid would of course instantly saturate this volatile alkali, and destroy the smell. Guano soaked in oil of vitriol may be dried and heated for hours at a temperature not exceeding  $212^{\circ}$  Fahr. without losing its peculiar smell; though it is hardly necessary to say that at that temperature ammonia cannot escape from a dry and very acid powder.

Damaged and wet guano should either be applied to the land without delay, or if this is impossible, it should be dried before it is stored away. To this end the guano may be thinly spread on a dry floor and be mixed with gypsum or a similar drying material. If sand or peat-mould or charcoal-dust is used, it may be well to moisten it at the same time with some oil of vitriol diluted with an equal bulk of water, for the acid will fix the free ammonia, which in wet guano amounts to  $1\frac{1}{2}$  to  $1\frac{3}{4}$  per cent.

The mixture may be exposed with advantage to direct sun-heat, or be submitted to a moderate artificial drying heat, and if heat cannot be applied conveniently, the moist guano-mixture should be turned over in a place exposed to a current of air.

*Water as a Solvent for Guano.*

It has been frequently noticed that Peruvian guano is not so efficacious in a dry season or localities as in a wet season or in districts where the rain-fall is high. This perhaps is one, but not the only reason why Peruvian guano is so highly and justly appreciated in the West of Scotland, and generally in the western counties, and why in several of the eastern counties it has been superseded in a great measure by superphosphate of lime.

Again, it has been observed that Peruvian guano is never more beneficially applied to the land than when a sufficient length of time is allowed for the rain to wash it into the land. These and similar observations tend to show that guano, like most highly-concentrated manure, produces the most beneficial effect upon vegetation when it has become thoroughly acted upon by water and its constituent elements have been uniformly diffused through the soil. That guano should be applied to the land at a time when heavy showers of rain or a succession of wet days may confidently be expected, is a rule with all good farmers; and it remains for the agricultural chemist to point out the reason why this should be done, and also to explain why, on the same soil and upon the same crop, guano at certain times acts much more beneficially than at others. The difference in the practical efficacy of Peruvian guano is intimately connected with the action of water on its constituents. A comparatively small quantity of water corresponding to a mere passing shower of rain falling on a field recently manured with guano appears to have a different effect from that of a large downfall on its constituents; as this subject has a direct practical bearing upon agricultural practice, I have carefully studied the action of water upon guano, and now proceed with a description of my experiments and a statement of my results.

*Experiments showing the effects of a definite and large quantity of Water on Peruvian Guano.*

The same three samples of guano, the composition of which is given in the beginning of this paper, were employed in the following experiments:—

100 grains of each sample were boiled up for a few minutes with half a decigallon of distilled water, another half decigallon of cold distilled water was added, and the mixed and muddy liquid allowed to settle for 24 hours in a stoppered glass-bottle. The clear liquid was then filtered off, and the insoluble matter collected, on a weighed filter. The insoluble matter was dried in a waterbath, weighed, and then burned. In the burnt residue the percentages of sand, insoluble phosphates, oxalate of lime,

and alkalis were determined by approved analytical processes, and in the soluble portion, those of soluble bone-earth, oxalic, sulphuric, and phosphoric acid, of chlorine, potash, and soda. The percentages of nitrogen both in the solution and in the insoluble matter were also determined.

The following Table embodies the results of these determinations :—

	No. I.	No. II.	No. III.
	Per Cent.	Per Cent.	Per Cent.
Portion soluble in water .. ..	57·01	48·92	48·01
Consisting of:—			
Moisture .. ..	15·14	18·42	16·56
Tribasic phosphate of lime .. ..	·60	·48	·44
Phosphoric acid .. ..	2·62	2·34	2·38
Equal to tribasic phosphate of lime .. ..	(5·68)	(5·08)	(5·16)
Sulphuric acid .. ..	6·29	2·88	3·30
Oxalic acid .. ..	5·70	5·67	5·18
Chlorine .. ..	1·48	1·50	1·02
Potash .. ..	3·69	1·91	1·71
Soda .. ..	1·62	1·47	·86
*Ammoniacal salts and soluble organic matters .. ..	19·87	14·25	16·56
Portion insoluble in water .. ..	42·99	51·08	51·99
Consisting of:—			
Insoluble phosphates .. ..	19·52	20·92	21·60
Oxalate of lime .. ..	·77	1·17	1·37
Potash and soda .. ..	·63	·61	·77
Insoluble siliceous matter (sand) .. ..	1·21	1·11	1·51
†Insoluble organic matters .. ..	20·86	27·27	26·74
	100·00	100·00	100·00
*Containing nitrogen .. ..	11·59	9·88	Not
Equal to ammonia .. ..	14·07	11·98	deter-
†Containing nitrogen .. ..	3·82	5·46	mined.
Equal to ammonia .. ..	4·67	6·63	

A glance at the preceding analytical result shows :—

1. That a large proportion of Peruvian guano is soluble in pure water.
2. That a small quantity of bone-earth passed into the solution.
3. That Peruvian guano contains soluble phosphoric acid in combination with alkalis in considerable quantities.
4. That it contains also oxalic acid.

On washing guano with water the oxalic acid in combination with ammonia passes into the solution as oxalate of ammonia.

5. That only a small amount of oxalic acid remained in the insoluble portion as oxalate of lime.
6. That the insoluble part of guano contained a little potash and soda.

It is not possible to wash these alkalies completely out of guano even where large quantities of boiling water are employed.

7. That by far the greater portion of the nitrogen contained in the organic matters of guano is soluble in water, and therefore may be supposed to be present in a readily assimilable state for the use of plants.

On burning, Peruvian guano leaves a perfectly white ash, which dissolves in hydrochloric acid without the least effervescence. The amount of sulphuric acid in this ash is much less than in the guano before it is burnt. The three samples, in which I found before burning 3·52 per cent., 2·88 per cent., and 3·30 per cent. respectively, gave ashes which contained only 1·29, 1·25, and 1·16 per cent. of sulphuric acid. As guano leaves only one-third of its weight, in round numbers, of ash, it is evident that by far the greater proportion of sulphuric acid which it contains, is dissipated by burning.

In the next experiment I tried to exhaust Peruvian guano completely with water.

100 grains were boiled repeatedly with large quantities of water, and the insoluble portion was washed upon a filter with distilled water for more than five days. Even after that time a little was dissolved, but as the washings then contained only a trace the exhaustion by water was discontinued, the insoluble matter collected on a weighed filter, dried at  $210^{\circ}$ , weighed, and then burned. The insoluble matter was analysed as before. The whole of the solution was exaporated to dryness, and the residue, after drying at  $212^{\circ}$ , weighed and analysed.

During the evaporation of the large quantity of fluid employed in exhausting the guano, ammonia was constantly given off, and as the complete evaporation and drying of the residue occupied nearly a week, a large proportion of uric and other nitrogenised compounds was destroyed and dissipated in the form of carbonate of ammonia. It will be seen by the subjoined analysis that no less than  $33\frac{1}{2}$  per cent. of organic matter were destroyed in this way.

The guano analysed in the usual way, that is without exhausting it first with water, produced the following results:—

Moisture .. .. .	15·90
Organic matter and ammoniacal salts .. .. .	53·73
Phosphates of lime and magnesia (bone-earth) ..	22·07
Alkaline salts .. .. .	7·17
Insoluble siliceous matter .. .. .	1·13

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100·00

*Containing nitrogen .. .. .	15·74
Equal to ammonia .. .. .	19·11



Nearly exhausted with water the same guano furnished the following proportions of soluble and insoluble matters:—

Percentage of soluble portion .. .. .	74·89
Percentage of insoluble portion .. .. .	25·11

Thus nearly three-fourths of the weight of the guano passed into solution, and one-fourth only was left behind insoluble. This portion we shall see presently consisted almost entirely of insoluble phosphates and insoluble siliceous matter.

The analysis of the soluble and the insoluble part gave the following results:—

Part soluble in water .. .. .	74·89
Consisting of:—	
Moisture .. .. .	15·90
Tribasic phosphate of lime .. .. .	2·92
Alkaline salts .. .. .	6·91
Containing phosphoric acid .. .. .	1·28
Equal to tribasic phosphate of lime .. .. .	(2·77)
Soluble organic matters (left in dried residue on evaporating the watery solution) .. .. .	14·42
Soluble organic matters (decomposed and resolved chiefly into ammonia compounds during evaporation) .. .. .	33·46
Part insoluble in water .. .. .	25·11
Consisting of:—	
Insoluble phosphates .. .. .	19·82
Oxalate of lime .. .. .	·56
Potash and soda .. .. .	·77
Insoluble siliceous matter (sand) .. .. .	1·36
Insoluble organic matter .. .. .	2·60
	<hr/>
	100·00

It is remarkable that the insoluble portion, notwithstanding that an immense quantity of water was passed through it, still contained some potash and soda, which it seems to have a great power of retaining. The phosphate of lime, which constitutes so large a part of the insoluble residuum, seems to have the power of forming with alkalis a chemical union which is broken up with great difficulty, and only very gradually, by boiling water.

The larger amount of bone-earth in this watery solution is accounted for by the large quantity of water used in the experiment. We have in this a direct proof that the insoluble phosphates in guano are rendered soluble by degrees by a sufficiently large quantity of water.

#### *Combined Action of Sulphate and Oxalate of Ammonia.*

Peruvian guano we have seen contains both sulphate and oxalate of ammonia. Liebig has shown that these two salts have an important function in rendering the insoluble phosphates

soluble. Insoluble phosphate of lime is more soluble in a liquid containing sulphate of ammonia than in pure water. When guano, therefore, is moistened with water, some of the insoluble phosphate, through the intervention of the sulphate of ammonia, becomes soluble, but as oxalate of ammonia is also present in solution, the oxalic acid forms with lime an insoluble salt, the phosphate of lime thus rendered soluble becomes changed into oxalate of lime, and phosphoric acid passes into solution. This action is slow, and its effects are therefore more marked when guano is kept for a considerable length of time thoroughly soaked with water.

With a view of ascertaining whether or not the insoluble phosphates in guano really become more soluble under the influence of sulphate and oxalate of ammonia, the following experiments were made. A weighed quantity of good Peruvian guano was exhausted at once with a large quantity of distilled water, and the matter insoluble in water collected on a filter and washed for a long time until very nearly all soluble matters were removed.

The guano furnished—

Matters soluble in water .. .. .	74.25	per cent.
Matters insoluble in water .. .. .	25.75	„

It contained—

Water .. .. .	16.57	„
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and yielded on combustion with soda-lime—

Nitrogen .. .. .	15.71	„
Equal to ammonia .. .. .	19.09	„

In the portion soluble in water I found—

Phosphoric acid .. .. .	3.13	„
Equal to tribasic phosphate of lime (bone-earth) .. .. .	6.78	„

In the insoluble part there was—

Tribasic phosphate of lime .. .. .	18.27	„
Oxalate of lime .. .. .	85	„

A second weighed quantity of the same guano was mixed with a little water and left for two days in a glass, after which time it was completely exhausted with distilled water like the first quantity. It produced—

Substances soluble in water .. .. .	74.44	per cent.
Substances insoluble in water .. .. .	25.56	„

In the soluble portion I found—

Phosphoric acid .. .. .	3.66	„
Equal to tribasic phosphate of lime .. .. .	7.94	„

The insoluble portion contained—

Tribasic phosphate of lime .. .. .	17.58	„
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We thus see that by moistening guano with water and leaving it for two days in this condition before extracting it with water, a small quantity of the insoluble phosphates was rendered soluble and passed into solution. The effect produced in the course of two days, however, was inconsiderable. A large quantity of the same guano therefore was drenched with water and kept in a wide-mouthed open bottle for three weeks. After 24 hours it gave off ammonia in abundance, and continued to do so during the whole time in which it was kept. At the end of three weeks a weighed quantity was exhausted with distilled water. It contained—

Moisture .. .. .	34.84 per cent.
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and yielded on combustion—

Nitrogen .. .. .	9.48	„
Equal to ammonia .. .. .	11.51	„

In the watery solution I found—

Tribasic phosphate of lime .. .. .	1.53	„
Phosphoric acid .. .. .	4.04	„
Equal to tribasic phosphate of lime .. .. .	8.76	„

In the insoluble portion—

Insoluble tribasic phosphate of lime .. .. .	14.10	„
Oxalate of lime .. .. .	4.69	„

In order to bring out more clearly the changes which the guano underwent in the period during which it was kept in a moistened state exposed to the air, the preceding results were calculated as follows, so as to adapt them to the normal condition of the guano; when it contained 16.57 per cent. of water—

Moisture .. .. .	16.57
Percentage of nitrogen .. .. .	12.13
Equal to ammonia .. .. .	14.73
Tribasic phosphate of lime in watery solution .. .. .	1.96
Phosphoric acid in watery solution .. .. .	5.10
(Equal to tribasic phosphate of lime .. .. .	11.06)
Insoluble tribasic phosphate of lime .. .. .	18.05
Oxalate of lime .. .. .	6.00

These results compared with the original analysis show unmistakably the injury which the guano sustained when kept in a thoroughly wet state for three weeks. The percentage of nitrogen has been reduced from 15.71 (equivalent to 19.07 per cent. of ammonia) to 12.13 (equivalent to 14.73 per cent. of ammonia).

During the active fermentation, into which moistened guano rapidly enters, a portion of its organic constituents is changed into carbonate of ammonia, which gradually evaporates; at the same time oxalic acid is produced; this acid acts upon the insoluble phosphates and renders a portion soluble. The decomposition of a portion of the organic matter and the subsequent loss of ammonia fully accounts for the larger amount of phosphates which occurs in samples of damaged guano. In the case

before us the guano sustained a loss of 3·58 per cent. of nitrogen, equal to 4·34 per cent. of ammonia, in the short period of three weeks, and as the loss increases with the length of time during which it is kept in a wet and fermenting condition, it is hoped no further argument is required to induce agriculturists to store Peruvian guano in a perfectly dry place, and to take care either to apply damaged guano at once to the land or, if that may not be done, to dry it.

The dissipation of organic matter necessarily raised the total percentage of phosphates, which rose from 25·05 per cent. of soluble and insoluble phosphates, calculated as tribasic phosphate of lime, to 31·07 per cent., being an increase of 6 per cent.

By far the larger proportion of the increase in phosphates, it will be seen, makes its appearance in the watery solution of the fermented guano. That the insoluble phosphates are rendered soluble, at least in part, through the joint action of sulphate and oxalate of ammonia on the earthy phosphates, appears evidently from the considerable proportion (6 per cent.) of oxalate of lime which was found in the fermented sample.

Moistening guano with water previous to use, although it increases the solubility of the phosphates, cannot be recommended, because this effect is attended with a loss of a great deal of ammonia.

### *Use of Sulphuric Acid.*

The insoluble phosphates may, however, be rendered soluble more perfectly by a little sulphuric acid without any loss of costly nitrogen; a quantity too small to give an acid reaction to the guano producing a most decidedly beneficial effect upon the insoluble phosphates.

Treated with only 5 per cent. of oil of vitriol, guano yields, as we shall see presently, quite half its amount of phosphoric acid to water; whilst without such treatment scarcely one-fifth of its phosphoric acid occurs in a soluble state.

The peculiar action of sulphuric acid upon guano is due to the presence of oxalate of ammonia and to the sulphate of ammonia which is then formed. With a view of studying experimentally the effect produced by very moderate additions of oil of vitriol, and of ascertaining in what proportions it should be added, I tried the following experiments:—

Four small quantities of good Peruvian guano were severally mixed with 5, 10, 15, and 20 per cent. of oil of vitriol ( $\text{SO}_3, \text{H O}$ ), and the mixture dried on the top of a waterbath, after which a weighed quantity was very nearly exhausted with distilled water. The soluble and insoluble portions were then in each case analysed separately. The guano employed in these four experiments contained in 100 parts—



Moisture .. .. .	13.27
*Organic matter and salts of ammonia .. .. .	54.68
Phosphates of lime and magnesia (bone-earth) .. .. .	23.33
†Alkaline salts .. .. .	7.28
Insoluble siliceous matter .. .. .	1.44

100.00

*Containing nitrogen .. .. .	15.50
Equal to ammonia .. .. .	18.82
†Containing phosphoric acid .. .. .	2.33
Equal to tribasic phosphate of lime .. .. .	5.05

This guano contained 5.87 per cent. of ammonia in the state of ammoniacal salts.

The addition of 5 per cent. of oil of vitriol imparted only a very faint acid reaction to the guano, thus showing that the acid did not act at once on the insoluble tribasic phosphate of lime.

With 10 per cent. of oil of vitriol a decidedly acid solution was obtained, and with the larger proportions of acid of course this effect was still more decided.

*Composition of Peruvian Guano dried with 5 per cent. of Oil of Vitriol*  
(SO<sub>3</sub>, H<sub>2</sub>O).

Water driven off on long drying at 212° Fahr. ..	4.63	} Percentage soluble in water, 62.87.
Bi-phosphate of lime .. .. .	1.36	
Equal to bone-earth, rendered soluble by acid ..	(2.12)	
Sulphate of lime .. .. .	1.84	
Alkaline salts .. .. .	11.13	
Containing phosphoric acid .. .. .	(6.46)	} Percentage insoluble in water, 37.13
Equal to tribasic phosphate of lime .. .. .	(13.99)	
*Soluble organic matter and salts of ammonia ..	43.91	
†Insoluble organic matter .. .. .	8.38	
Insoluble phosphates .. .. .	14.70	
Oxalate of lime .. .. .	12.37	}
Insoluble siliceous matter .. .. .	1.68	
100.00		
*Containing nitrogen .. .. .	11.44	
Equal to ammonia .. .. .	13.88	
†Containing nitrogen .. .. .	3.66	
Equal to ammonia .. .. .	4.45	

The preceding figures suggest the following remarks:—

1. The small addition of 5 per cent. of oil of vitriol had the effect of rendering fully one-half or the phosphates soluble in water. For the total percentage of phosphate amounted to 30.81. In this quantity we have—

Soluble in water:—

Bi-phosphate of lime, calculated as tribasic phosphate of lime	2.12
Phosphoric acid in combination with alkalis, calculated as } tribasic phosphate of lime .. .. .	13.99

Soluble phosphates, calculated as tribasic phosphate of lime ..	16.11
Insoluble phosphates .. .. .	14.70

Total amount of phosphates .. .. . 30.81

Before treatment this guano contained 28·38 per cent. of phosphates, and in this quantity only 5·05 per cent. in a soluble state, and 23·33 per cent. as insoluble phosphates. These figures show the great utility of mixing guano with a little oil of vitriol. The acid not only fixes any free carbonate of ammonia (which in damaged or in wet guano may amount to more than  $1\frac{3}{4}$  per cent.), but it has also the more important effect of rendering soluble a large proportion of the insoluble phosphates.

2. When guano is exhausted merely with water, the portion insoluble in water is found on analysis to contain very little oxalate of lime; in that case nearly the whole of the oxalic acid in guano remains in the watery solution. But when guano is dried with only 5 per cent. of sulphuric acid, nearly the whole of the oxalic acid is left behind as oxalate of lime in the portion insoluble in water, and an equivalent proportion of phosphoric acid is liberated from the insoluble phosphates and passes into solution in combination with ammonia and potash.

3. It will be noticed that, of the total amount of nitrogen in this sample of sulphated guano, three-fourths is present in a state soluble in water, and only one-fourth is insoluble. There can, however, be no doubt that these insoluble nitrogenous compounds become readily transformed into soluble combinations, which are easily assimilated by plants.

*Composition of Peruvian Guano dried on a Waterbath with 10 per cent. of Oil of Vitriol ( $\text{SO}_3, \text{H}_2\text{O}$ ).*

Water given off on long drying at $212^\circ$ Fahr. .. ..	4·58	} Percentage soluble in water, 65·59.
Bi-phosphate of lime .. .. .	1·51	
Equal to bone-earth rendered soluble .. .. .	(2·37)	
Sulphate of lime .. .. .	2·09	
Alkaline salts .. .. .	10·96	
Containing phosphoric acid .. .. .	(7·09)	} Percentage insoluble in water, 34·41.
Equal to tribasic phosphate of lime .. .. .	(15·36)	
*Soluble organic matter and salts of ammonia .. ..	46·45	
†Insoluble organic matter .. .. .	7·28	
Insoluble phosphates .. .. .	12·24	
Oxalate of lime .. .. .	13·33	} Percentage insoluble in water, 34·41.
Insoluble siliceous matter .. .. .	1·56	
100·00		
*Containing nitrogen .. .. .	12·00	
Equal to ammonia .. .. .	14·57	
†Containing nitrogen .. .. .	3·43	
Equal to ammonia .. .. .	4·16	

As might have been expected, the guano by the addition of 10 per cent. of acid is rendered slightly more soluble than by 5 per cent.

The effect produced by the larger amount of acid, however, is scarcely commensurate to the increase of acid; for, with 10 per

cent. of acid only  $1\frac{3}{4}$  per cent. more of soluble phosphates were found in the guano than with 5 per cent. in these two instances.

It will be seen that the proportion of bi-phosphate of lime is almost the same, but that the phosphoric acid in combination with alkalis was rather larger when more acid was used.

On the whole, the additional 5 per cent. of sulphuric acid were not expended to much advantage.

*Composition of Guano dried with 15 per cent. of Oil of Vitriol*  
( $\text{SO}_3, \text{HO}$ ).

Water driven off on long drying at $212^\circ$ Fahr.	..	4.77	} Percentage soluble in water, 67.68.
Bi-phosphate of lime .. .. .	..	2.74	
Equal to bone-earth render soluble .. .. .	..	(4.28)	
Sulphate of lime .. .. .	..	3.74	
Alkaline salts .. .. .	..	11.02	
Containing phosphoric acid .. .. .	..	(7.11)	
Equal to tribasic phosphate of lime .. .. .	..	(15.40)	} Percentage insoluble in water, 32.32.
*Soluble organic matter and salts of ammonia .. .. .	..	45.41	
†Insoluble organic matter .. .. .	..	10.37	
Insoluble phosphates .. .. .	..	8.23	
Oxalate of lime .. .. .	..	12.23	
Insoluble siliceous matter .. .. .	..	1.49	
100.00			
*Containing nitrogen .. .. .	..	12.07	
Equal to ammonia .. .. .	..	14.66	
†Containing nitrogen .. .. .	..	2.34	
Equal to ammonia .. .. .	..	2.83	

On looking over these results, it will be seen that the solubility of the guano is again increased by the additional quantity of acid.

The proportion of bi-phosphate of lime is greater than in the sample treated with 10 per cent. of acid, but the amount of soluble phosphoric acid combined with the alkalis is about the same in both cases.

Corresponding with the proportion of soluble phosphoric acid in the alkalis, the amount of oxalate of lime in this experiment remained about the same as in the preceding one.

Lastly, it will be seen that the nitrogenous matter is made more soluble by the larger amount of sulphuric acid.

It will be noticed that the solubility of the guano is still further increased, so that only  $26\frac{3}{4}$  per cent. remained insoluble in water.

The additional quantity of sulphuric acid acted upon the insoluble phosphates; about 8 per cent. were rendered soluble, and only 3 per cent. were left in an insoluble state.

It may be inferred from this experiment that 25 per cent. of oil of vitriol, or one-fourth the weight of the guano, would have rendered the whole of the phosphates, and nearly the whole of the nitrogenous matter, perfectly soluble in water.

*Composition of Guano dried with 20 per cent. of Oil of Vitriol*  
( $\text{SO}_3, \text{HO}$ ).

Water driven off at $212^\circ$ Fahr. .. ..	5.44	} Percentage soluble in water, 73.24.
Bi-phosphate of lime .. ..	5.36	
Equal to tribasic phosphate of lime .. ..	(8.37)	
Sulphate of lime .. ..	7.31	
Alkaline salts .. ..	10.54	
Containing phosphoric acid .. ..	(6.68)	} Percentage insoluble in water, 26.76.
Equal to tribasic phosphate of lime .. ..	(14.47)	
*Soluble organic matter and salts of ammonia .. ..	44.59	
†Insoluble organic matter .. ..	9.50	
Insoluble phosphates .. ..	3.06	
Oxalate of lime .. ..	12.97	}
Insoluble siliceous matter .. ..	1.23	
100.00		
*Containing nitrogen .. ..	3.01	
Equal to ammonia .. ..	3.65	
†Containing nitrogen .. ..	10.59	
Equal to ammonia .. ..	12.86	

In all the four trials, with 5, 10, 15, and 20 per cent. of acid, the amount of soluble phosphoric acid in the alkalies and of oxalate of lime in the part insoluble in water differed but inconsiderably.

By the agency of oxalic acid, naturally present in the guano, assisted by only 5 per cent. of sulphuric acid, a very large proportion of the insoluble phosphates are thus rendered soluble in water; and the larger quantities of acid were expended in the foregoing experiments with far less economical advantage than the first 5 per cent.

On the strength of these experiments, I would strongly recommend the addition of about 5 per cent. of oil of vitriol to guano as a cheap and ready means of greatly increasing its efficacy. The expense of so small a quantity of acid is too trifling to require a moment's consideration. Some difficulty, however, I anticipate may be felt in incorporating the acid uniformly with the guano. As the proportion of acid to that of the guano is very small, an intimate mixture cannot be effected by simply pouring the acid upon the latter, nor is it desirable to use the acid in a concentrated state.

*Practical Directions.*

I would therefore suggest the following plan:—In the first place, dilute the oil of vitriol with about an equal bulk of water, and then sprinkle the dilute acid over dry sawdust, or, if that cannot be had, over ground gypsum or sand. Dry sawdust takes up a great deal of liquid without appearing particularly wet. Gypsum or sand do not take up so much liquid, and



must be used in sufficient quantities to absorb completely the acid. By thoroughly mixing the guano, previously reduced to fine powder with sawdust, gypsum, or sand, slightly wetted by the acid, both may be intimately incorporated with each other.

We have seen in the preceding pages that the efficacy of Peruvian guano may be greatly increased by improving its mechanical conditions, also by the addition of common salt, and especially by treatment with a small quantity of oil of vitriol. I am convinced if the suggestions which I offer are carried into practice, a considerable saving in the expense of the guano will be realized, for it will then be applied to the land in an improved mechanical condition and in a state of increased chemical efficacy.

12, Hanover Square, London, W.,  
February 1864.

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#### VII.—*Report on International Agricultural Meeting at Lille.*

At the Meeting of the Council of the Royal Agricultural Society, on 1st April, 1863, it was resolved (on the invitation of the municipal authorities of the city of Lille and of the Prefect of the Department) that "Sir A. K. Macdonald and Professor Wilson be deputed to attend on the Jury on Agricultural Implements at the forthcoming International Exhibition near that town." In obedience to this resolution we attended the meeting, and now beg to submit to the Council the following brief Report of its principal features, and of the duties we were invited to take part in.

In France the department of agriculture forms a prominent feature of the imperial executive, and each year great meetings or shows are held, at which large sums of money are expended in promoting improvements in the various processes of stock and tillage husbandry. For this purpose the country has been divided into distinct districts (*régions*), in each of which a competitive agricultural exhibition (*concours régional agricole*) is held each year, under the direction and personal superintendence of an officer (*Inspecteur-Général d'Agriculture*), appointed by the Minister of Agriculture for that special service. At these meetings the exhibitors are, as a rule, confined to those farmers and others residing within the districts specified; and in no case hitherto had these meetings assumed anything of a national, much less of an international character, by the admission of strangers as competitors in the exhibition.

On the present occasion the district referred to comprised the

following departments :—L'Aisne, le Nord, Pas de Calais, la Somme, l'Oise, Seine et Marne, Seine et Oise, and la Seine; and the city of Lille, the capital of the "Département du Nord," was fixed upon for the meeting. The locality was well adapted for the introduction of the new element of competition—the admission of foreign exhibitors to the meeting. The accommodation both for exhibitors and their stock was ample and well arranged, while the railway and general facilities of transport placed it readily within reach of the countries most likely to take advantage of the invitation of the authorities. These were, however, as might be expected, limited both as to nations and as to numbers of exhibitors, Belgium, Holland, and Great Britain being the only countries represented; the two former chiefly contributing specimens of their various breeds of stock; while our entries were confined entirely to machinery and implements.

In addition to the competition between the exhibitors of stock and of implements the annual "Prize of Honour" had to be awarded "to the agriculturist of the department (du Nord) whose *exploitation*" compared with other rural properties in the department should be considered the best managed, and where the improvements carried out were of the most useful character, and such as were desirable as examples to others." This prize, which is open to all persons farming within the department, consists of a sum of 5000 francs (200*l.*) in money and of a silver cup of the value of 3000 francs (120*l.*); besides which the jury has the power of awarding a sum of 500 francs (20*l.*), three silver medals, and three bronze medals, to the persons employed on the property who have aided in carrying out the improvements.\*

The Show was held on the esplanade in front of the citadel. The arrangements for the exhibition of the stock were very tasteful and complete, long ranges of roomy sheds being prepared for their reception. For a small proportion of the machines, &c., shed accommodation was afforded; the rest was arranged along the alleys of the esplanade.

The duties assigned to us by the administration were to assist in the examination and adjudication of awards to the machinery and implements. For the purposes of division of labour and economy of time the machinery department was divided into two classes: the one comprising those machines, &c., used in the outdoor, the other those used in the indoor work of the farm; Professor Wilson was the English representative in the first, and Sir A. K. Macdonald in the latter division of the Jury. The awards in this department of the Show were confined to medals of gold, silver,

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\* In vol. xxiv. p. 8, 'Royal Agricultural Society's Journal,' full details have been given of the working of these prizes in the different agricultural districts (*régions*) of France during the past year (1862.)

and bronze, with honourable mentions for exhibits of inferior merit. In the stock classes sums of money, varying from 100 francs to 600 francs, were given in addition to medals.

The articles exhibited in the first class (for outdoor use) were arranged under the following heads:—

Ploughs; subsoil-ploughs; harrows; rollers; scarifiers, cultivators; sowing-machines; horse-hoes; moulding-ploughs; mowing machines; haymaking machines; horse-rakes; reaping-machines; farm-carts, waggons; farm-harness; manure-pumps; beehives; implements for manual use.

The second class (for indoor use) comprised:—

Pug-mills; drain-tile making machines; draining-tools; horse works; fixed steam-engines; moveable steam-engines; fixed threshing and finishing machines; moveable threshing and finishing machines; fixed threshing and winnowing machines; moveable threshing and winnowing machines; fixed threshing-machines (simple); moveable threshing-machines (simple); corn-screens; sieves and riddles; grain-crushing machines; root-cutting machines; straw and chaff cutters; cooking-apparatus; churns; weighing-machines; instruments used in the indoor operations of the farm.

The arrangements for testing the powers and efficiency of these several machines and implements were not so complete and satisfactory as those we are accustomed to find at our own great Shows. For the field-trials the area was too limited, and the crops not well suited to test fairly their capabilities.

The Awards of the Jury which we venture to submit for record were as follows. In the first division or class:—

Ploughs:—Messrs. Ransome and Sims	.. ..	1st Prize, Gold Medal.
Subsoil-Ploughs:—J. and F. Howard	.. ..	1st Prize, Gold Medal.
Harrows:—J. and F. Howard	.. ..	1st Prize, Silver Medal.
„ Ashby and Co.	.. ..	Honourable Mention.
Rollers:—A. E. Crosskill	.. ..	1st Prize, Silver Medal.
„ Amies and Barford	.. ..	Honourable Mention.
Scarifiers:—C. Clay	.. ..	1st Prize, Silver Medal.
„ Coleman and Son	.. ..	2nd Prize, Bronze Medal.
„ Underhill	.. ..	Honourable Mention.
Sowing-Machines:—Smith and Sons	.. ..	1st Prize, Gold Medal.
„ Garrett and Son	.. ..	1st Prize, Silver Medal.
„ Reeves	.. ..	2nd Prize, Bronze Medal.
Horse-hoes:—Garrett and Son	.. ..	1st Prize, Silver Medal.
„ Underhill	.. ..	Honourable Mention.
Moulding-Ploughs:—Underhill	.. ..	1st Prize, Bronze Medal.
„ J. and F. Howard	.. ..	Honourable Mention.
Mowing-Machines:—Picksley and Co.	.. ..	1st Prize, Gold Medal.
„ Walter A. Woods	.. ..	2nd Prize, Silver Medal.
Hay-making-Machines:—Nicholson	.. ..	1st Prize, Gold Medal.
„ J. and F. Howard	.. ..	2nd Prize, Silver Medal.
„ Ashby and Co.	.. ..	Honourable Mention.
„ Boby	.. ..	Honourable Mention.

Horse-Rakes :—Nicholson .. .. .	1st Prize, Silver Medal.
Ransome and Sims .. .. .	2nd Prize, Bronze Medal.
Reaping-Machines :—Bamlett .. .. .	1st Prize, Gold Medal.
Ransome and Sims .. .. .	2nd Prize, Silver Medal.
W. A. Woods .. .. .	3rd Prize, Bronze Medal.
Carts and Waggon :—Crosskill .. .. .	1st Prize, Gold Medal.
" .. .. .	2nd Prize, Silver Medal.
Tools, &c., for manual use ;—Picksley and Co. ..	1st Prize, Silver Medal.

**In the second division or class :—**

Pugmills :—Whitehead .. .. .	1st Prize, Silver Medal.
Horse Works :—Ransome and Sims .. .. .	1st Prize, Gold Medal.
Picksley and Co. .. .. .	2nd Prize, Silver Medal.
Steam-Engines :—Ransome and Sims .. .. .	1st Prize, Gold Medal.
Ruston and Proctor .. .. .	2nd Prize, Silver Medal.
Garrett and Son .. .. .	3rd Prize, Bronze Medal.
Underhill .. .. .	Gold Medal.
Threshing and Finishing-Machines :—Ransome and Sims .. .. .	1st Prize, Gold Medal.
Threshing and Finishing-Machines :—Ruston and Proctor .. .. .	2nd Prize, Silver Medal.
Threshing and Finishing-Machines :—Turner ..	3rd Prize, Bronze Medal.
Screens :—Boby .. .. .	1st Prize, Silver Medal.
Ransome and Sims .. .. .	2nd Prize, Bronze Medal.
Riddles, &c. :—Boby .. .. .	1st Prize, Silver Medal.
Nalder .. .. .	2nd Prize, Bronze Medal.
Grain-Crushers :—Turner .. .. .	1st Prize, Silver Medal.
Ransome and Sims .. .. .	2nd Prize, Bronze Medal.
Picksley and Co. .. .. .	Honourable Mention.
Root-Cutters :—Picksley and Co. .. .. .	1st Prize, Silver Medal.
Ransome and Sims .. .. .	2nd Prize, Bronze Medal.
Straw-Cutters :—Picksley and Co. .. .. .	1st Prize, Silver Medal.
Ashby and Co. .. .. .	2nd Prize, Bronze Medal.
Ransome and Sims .. .. .	Honourable Mention.
Cooking-Apparatus :—Amies and Barford ..	1st Prize, Silver Medal.
Churns :—Eastwood .. .. .	1st Prize, Silver Medal.

A Bronze Medal was also awarded to G. Bower for his arrangement of gas-works suitable to farm-establishments.

This list of awards will show how large a share of the prizes at the disposal of the Jury fell to our own countrymen. The various articles exhibited, though fairly upholding the character of their respective countries, offered no novelty of arrangement or manufacture, and call for no further remark from us.

In addition, however, to the general list, a "special prize" was offered for "steam-ploughs or cultivators." This we understood to have been given by the city of Lille, *although we had no official information as to the amount of the prizes or the conditions under which they were to be awarded.*

Two competitors appeared in the field, one French and the other English. France was represented by M. Kienzy, with his "locomotive cultivator," and England by the Messrs. Howard, with their improved arrangement of "steam traction-ploughs."



The latter is too well known to need any special remark; the former, however, we cannot pass over so readily, as it appeared to us to possess, in its mechanical arrangement, more of the elements of success than we have hitherto met with in the machines of this class which have been from time to time exhibited in England.

The working parts forming the cultivator, or digger, were attached to the hind part of an ordinary field locomotive-engine. The engine, of 8-horse power, with double cylinders, was carried on four broad wheels; the two fore-wheels, guided from the hind plate by a long pinion-rod, formed the steerage; while the large driving wheels were actuated, separately, direct from the crank by toothed wheels. At the back, on each side of the hind plate, or platform, were tanks for carrying a small stock of fuel and of water. The accompanying woodcuts will explain the mode of arrangement and working of the cultivators; the five-cranks axle, on which they were fixed, being driven by a pitch-chain from the main shaft.

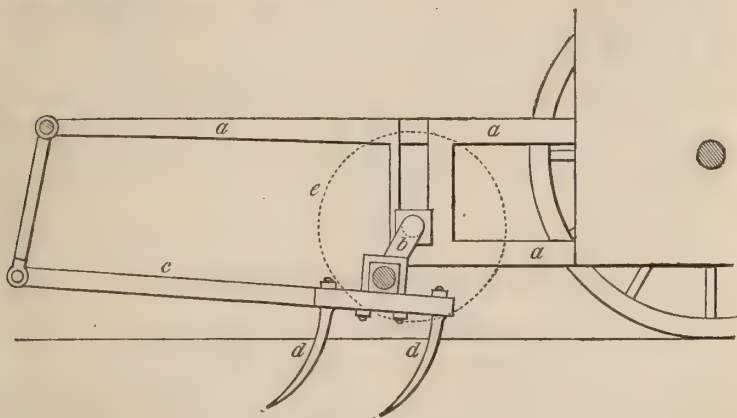


Fig. 1. Vertical Section of Working Parts.\*

When the engine is in motion each revolution of the axle forces the tines into, and again withdraws them from the soil over which it passes, displacing the mass before them, and throwing it over that moved by the preceding cut. By a simple mechanical arrangement the cranked axle can be elevated or lowered, so as to suit the depth of work required, or to allow of the cultivator turning at the end of the lands.

\* Owing to the failure on the part of the exhibitor to furnish working drawings of the cultivator as promised by him, the present have been drawn from memory, assisted by a rough sketch made at the time of the trials. They are, however, I believe, correct in every essential particular.—I. W.

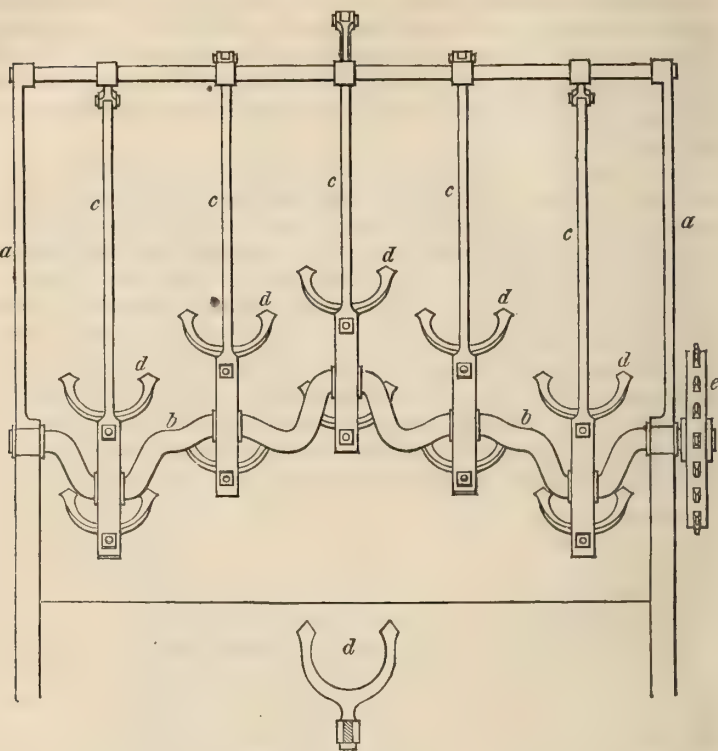


Fig. 2. Horizontal View of Working Parts.

*Description of Working Parts of Cultivator.*

- a. Frame in stout bar iron attached to hind platform of engine.
- b. 5-cranked axle, with 6-inch throw.
- c. Lever arms carrying digging-tines, bolted on to cranks and attached by swinging bars at end to frame (a).
- d. Digging-tines, 2-pronged with broad flat blades, fixed one before and one behind the crank.
- e. Driving-wheel of axle actuated by pitch-chain from main shaft of engine.

The surface operated upon was 1.75 *mètres* (equal to 5 ft. 8 in.) in width, being a few inches on each side beyond the tracks of the driving wheels. The soil of the trial-ground was a deep alluvial loam, of moderate tenacity, but strongly matted together on the surface by a vigorous growth of couch (principally *Agr. stolonifera*), and other natural grasses. The subsoil was in a very indurated condition, thus presenting some difficulties, and offering considerable resistance to steam-cultivation. The engine was driven at the rate of sixty revolutions per minute,

with a steam-pressure of 80 lbs. to 90 lbs. The length of the furrow was about 60 *mètres*, or 66 yards. The average time taken in passing over it was about three minutes, the work done was therefore at the rate of rather more than half an acre per hour. Owing to the driving wheels being moved independently of each other, the turning at the end of the furrows was accomplished very quickly, *i.e.*, in about sixty seconds, on the average. In the beginning of the trial the depth of soil cultivated measured from 25 to 30 *centimètres* (9·825 to 11·79 inches). The work was then set deeper, and a depth of fully 35 *centimètres* (13·755 inches) was obtained. The surface of the field, owing to heavy rains and a thick growth of old couchy grass, was in a condition far from favourable to the working of a "locomotive" cultivator. The engine, however, travelled readily over the appointed ground, and the soil was lifted, the sward fairly covered, a fine tilth obtained, and the ground operated upon left in a very satisfactory condition.

We have thought it desirable thus to give the details of this "locomotive cultivator or digger," inasmuch as although the engine as well as the working parts of the cultivator were of rather rough workmanship, and admitted in more than one point of mechanical improvement, the machine did its work without stoppages in a very satisfactory manner.

Hitherto the various attempts that have been made in this country to bring a *working* locomotive plough or cultivator into the field have been unsuccessful: Usher's at the Carlisle meeting, Rickett's at Chester, and Romaine's at Warwick and Leeds, having in each case failed to perform the work allotted to them, and being in consequence withdrawn from the competition. Without wishing to draw any comparison between the merits of the "locomotive" and the "steam-traction" systems of cultivation, we cannot but express an opinion, that, in regard to the comparatively small first cost of the apparatus, the low rate of its working expenses, including wear and tear, and the quality of the work performed,\* the locomotive system of tillage still has claims upon our consideration, notwithstanding the failures of former attempts.

ARCHIBALD KEPPEL MACDONALD.

JOHN WILSON.

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\* "Messrs. Brown and May, of Devizes, worked Romaine's rotary cultivator or digging-machine on Plot 6. The work done, though but little, was certainly the best in the field, the soil being finely pulverized to the depth of 7 inches." Report of Judges of Steam Cultivators at the Leeds Meeting, 1861, 'Royal Agricultural Society's Journal,' vol. xxii. p. 464.

VIII.—*Report on International Agricultural Exhibition at Hamburg.* By JOHN WILSON, Professor of Agriculture in the University of Edinburgh, &c.

THE Great Exhibition of 1851 formed a memorable epoch in the history of most of our industries; in none have its important bearings and effects been more evident than in those connected with our agriculture. Before that period, it is true, the more advanced and enterprising agriculturists of the Continent from time to time had visited this country, become acquainted with our husbandry, and purchased our live stock and our implements; but it needed some great occasion like that which called together, in Hyde Park, the representatives of industry from all the civilized countries of the world to make that knowledge general, and its results productive of benefit both to our visitors and to ourselves.

At that International Exhibition the class of agricultural machinery excited the greatest interest. Each country had sent its best to meet beneath the same roof, and be compared with the best our own makers could turn out. All who went there learned a valuable lesson. We learned what our visitors' requirements were, and they had an opportunity of judging for themselves how far we were able to supply them. The stimulus then given to the manufacture of our agricultural machines, and its rapid and regular increase since, are too well known and too generally acknowledged to need any confirmatory evidence; the more widely our machines and implements are exhibited, and the more often they are tested by practical comparison with those of other countries, the better their real values are seen, and their superiority made known. For this purpose no combination of circumstances can be so favourable as that offered by an International Exhibition. By our own great annual meetings the market for our implements is extended from the different localities of manufacture to the furthest parts of the country; by an International Exhibition it is extended all over the cultivated world.

Since 1851 two great International Agricultural Exhibitions have been held,—both at Paris. The first, in 1855, was in connexion with the general Industrial Exhibition in that year; the other took place in the following year, and upon a larger and more comprehensive scale. To each of these Great Britain was a large contributor both of stock and implements, and carried off a full share of the prizes.

It would appear that the benefits resulting from these international gatherings are becoming each year more recognised; and other countries have since then proffered, either in whole



or in part, the same invitation that France gave in 1855 and 1856. Last year our agriculturists were invited to take part in three International Meetings—at Lille,\* in France; at Odensee (Funen), Denmark; and at Hamburg. At the two first named, our contributions were limited to implements and machinery; but the Exhibition at Hamburg was upon such a large scale—so exceptional in its locality and in its character, and so satisfactory in its results—that the following sketch of its history, arrangements, and general details may not only be interesting, but also of advantage, if taken merely as a standard of comparison for future as well as past agricultural exhibitions, whether at home or abroad.

The territory of the Free State of Hamburg is very limited, and its direct interest in the promotion of agricultural industry reduced to the smallest proportions. Neither could the agricultural status of the neighbouring countries of Holstein, Mecklenburg, and Hanover be looked upon as of sufficient importance to have originated the great scheme undertaken by the citizens of Hamburg for its honour and advancement.

There is no doubt that, although not directly for her own wants, still indirectly for her own benefit, Hamburg is deeply interested in the development of the agricultural resources of Northern Germany. The Elbe is the great outlet for the surplus produce of her soil, and at the same time the entrance-gate for the admission of machinery for the better preparation of her produce, and of stock for the improvement of her farms. At Hamburg commerce exacts a toll from all that passes along her water highway, whether exports or imports; and her merchant citizens at once recognised the policy of a movement in the results of which, though not directly concerned, they would indirectly so largely participate.

The idea of an International Agricultural Exhibition appears however to have originated with Baron von Nathusius, of Hundisburg (Prussia), the President of the German Agricultural Society, well known here, as at home, for the lead he has taken for many years past in advancing the agriculture of his own country, by the introduction of improved breeds of stock, and improved implements and machinery. Hamburg offered by far the most advantageous site for such an Exhibition, not more from its geographical than from its political position. A free and neutral city, situated on a large tidal river, with lines of railway stretching far and wide throughout the length and breadth of Germany, all the local natural conditions for success were present; while the liberality and business habits of her merchants, unfettered by traditions or the established practices on such occasions, were likely to render the organization of such a meeting more com-

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\* See Report on the Lille Meeting at p. 209.

plete and more effective, than it would have proved if confided to the hands of any purely agricultural body. The suggestion of Baron von Nathusius was at once taken up by the citizens of Hamburg; a "guarantee fund" was subscribed for by sixty of the leading merchants, and an Executive Committee formed, under the presidency of the late lamented Baron Ernst Merck, through whose enlarged views and able and energetic management the idea increased in its proportions and its importance, until, when the gates were opened for the reception of visitors (July 14th), a representative Exhibition of productive industry, more comprehensive and more complete than had hitherto been seen, had been organised, and the outlay of an amount approaching to 20,000*l.* had been incurred.

The scheme of the Hamburg merchants met with the success it deserved: it was at once appreciated and accepted by all the principal countries on the Continent, whose leading agriculturists inscribed their names on the list of exhibitors. The following countries appeared as exhibitors:—Austria, Anhalt, Baden, Bavaria, Belgium, Brunswick, Canada, Denmark and the Duchies, Frankfort, France, Federal States of America, Great Britain, Hamburg, Holland, Hanover, Hesse Cassel, Hesse Darmstadt, Lippe, Lubeck, Mecklenburg-Schwerin, Mecklenburg-Strelitz, Nassau, Oldenburg, Prussia, Russia, Saxony, Sweden and Norway, Spain, Switzerland, Uruguay, Venezuela, Wurtemberg.

The Exhibition was distributed among the usual departments for Stock, Implements, and Products; and to these the addition of a Flower Show afforded both relief and increased enjoyment to the numerous visitors. The stock was divided into Horse, Cattle, Sheep, and Swine classes. The horses were subdivided into 36 classes, containing 524 animals. The cattle classes were 71 in number, and consisted of 965 animals. The sheep classes were 29 in number, and contained 1766 animals. Those assigned to swine were 18 in number, and contained 293 animals. The Poultry numbered 321 specimens, which were classified merely as regards their genus. In the Machinery Department there were 350 exhibitors; and in that for agricultural products 527 exhibitors. To this large list Great Britain contributed in the following proportions—to the horses 67; to the cattle, 132; to the sheep, 400; to the swine, 89; or 688 head of live-stock in all. In the Machinery Section 73 Firms were exhibitors; and four British exhibitors sent in specimens of farm products. Thus the contributions from Great Britain amounted to 12·786 per cent. in the horse classes; in the cattle, to 13·782 per cent.; in the sheep, to 22·727 per cent.; in the swine, to 30·375 per cent.; in the machinery section, to 20·856 per cent.; and in the section of agricultural pro-

ducts, to 759 per cent. of the entire materiel of the Exhibition.

The successful competitors in the Horse Classes were—Mr. Groves, who took two prizes of the value of 200 thalers, or 30*l.*; Mr. J. Crisp, who took six prizes amounting to 475 thalers, or 71*l.* 5*s.*; Mr. Holmes, four prizes, 500 thalers, or 75*l.*; Mr. Smith, one prize of 50 thalers, or 7*l.* 10*s.*; Mr. W. Wilson, one prize of 100 thalers, or 15*l.*; and Sir C. B. Phipps, who took three prizes of the value of 200 thalers, or 30*l.*

In the Cattle Classes the successful competitors were—

		Prizes.		Thalers.	£.	s.
Mr. D. Smith	.. ..	6	amounting to	480	=	72
Mr. J. Stewart	.. ..	3	"	195	=	29 5
Mr. J. Crisp	.. ..	3	"	350	=	52 10
M. J. Meikle	.. ..	2	"	75	=	11 5
Lord Walsingham	.. ..	1	"	100	=	15 0
Mr. E. Mertens	.. ..	1	"	100	=	15 0
Mr. T. Barbe	.. ..	1	"	50	=	7 10
Mr. J. Groves	.. ..	1	"	100	=	15 0
Mr. T. Lyall	.. ..	1	"	50	=	7 10
Mr. H. Gebhard	.. ..	1	"	50	=	7 10
Mr. T. Coulson	.. ..	1	"	70	=	10 10

The following received commendations: \*—Lord Kinnaird, and Messrs. Sadler, J. Groves, Crisp, R. Smith, H. Gebhard, T. Lyall, and D. Smith.

In the Sheep Classes the following prizes were awarded:—

		Prizes.		Thalers.	£.	s.
Lord Walsingham	.. ..	4	amounting to	150	=	22 10
Mr. W. Hemming	.. ..	3	"	65	=	8 15
Mr. W. Humphrey	.. ..	2	"	75	=	11 5
Mr. E. Mertens	.. ..	2	"	50	=	7 10
Mr. D. Smith	.. ..	2	"	40	=	6 0
Mr. J. Groves	.. ..	2	"	75	=	7 10
Mr. R. Smith	.. ..	2	"	50	=	7 0
Mr. T. B. Marshall	.. ..	2	"	100	=	15 0
Mr. W. Guerrier	.. ..	1	"	50	=	7 10
Mr. J. Clarke	.. ..	1	"	25	=	3 15
Mr. E. Handy	.. ..	1	"	50	=	7 10
Mr. R. Garne	.. ..	1	"	25	=	3 15
Mr. J. Gibson	.. ..	1	"	50	=	7 10
Mr. R. S. Skirving	.. ..	1	"	25	=	3 15
Lord Kinnaird	.. ..	1	"	50	=	7 10

\* The general term "commended" is here used; as the mode of wording the commendations by the Juries was not only dissimilar in the different classes, but even in the same class. The following expressions used by the Juries each bear a different signification:—"Anerkennung;" "Mit ehrenvoller Erwähnung;" "Ruhmliche Anerkennung;" "Auszeichnung;" "Ehrenwerthe Anerkennung;" "Ehrenvoll Erwähnt wurden;" "Ehrenvolle Anerkennung fanden;" "Erwähnt wurden;" "Anerkannt wurden;" "Lobend erwähnt wurden." These differences in expression, as also the indistinct and inconspicuous method adopted of designating the prize animals, will no doubt be changed at any future Exhibition.

Commendations were awarded to—Messrs. Gebhard, W. Taylor, J. Druce, R. Smith, J. Groves, T. B. Marshall, R. Garne, T. B. Browne, E. Mertens, R. S. Skirving.

In the Swine Classes the following obtained prizes:—

	Prizes.		Thalers.	£. s.
Mr. T. Crisp .. ..	6	amounting to	230	= 34 10
Mr. W. B. Wainman ..	6	"	200	= 30 0
Mr. J. Hickman .. ..	5	"	205	= 30 15
Mr. G. M. Sexton .. ..	4	"	110	= 16 10
Sir C. B. Phipps .. ..	1	"	25	= 3 15

Commendations were awarded to Mr. T. Crisp, Sir C. B. Phipps, Messrs. G. M. Sexton, J. Hickman, W. B. Wainman, R. Smith.

The aggregate money value of the prizes thus taken by British exhibitors was—for horses, 1525 thalers, or 228*l.* 15*s.*; for cattle, 1520 thalers, or 228*l.*; for sheep, 880 thalers, or 132*l.*; for swine, 770 thalers, or 115*l.* 10*s.*: in all, 4695 thalers, or 705*l.* 5*s.*

My colleagues on the Jury, Messrs. Weatherby, Barthropp, and Robert Smith, have favoured me with their opinions of the merits of the classes they were respectively called upon to judge. Mr. Weatherby, who was a member of the Jury for the Thoroughbred Stock, states that, "The classes of thoroughbred horses were so very indifferent that it was often hard to say which was the best amongst so many bad ones. In my opinion no prize at all ought to have been given; but my colleagues took a different view. All good judges were very much disappointed with our class, which was almost the worst in the Show. In the Arab Class the first prize was given to an *extraordinary* animal of the highest possible type of the race, a sight in himself worth all the trouble of the journey to Hamburg. The rest were of quite another order. The arrangements made for the accommodation of the animals were so good that, with my experience of English Shows, I was quite taken by surprise. It is very difficult to get together a good class of thoroughbred stallions in England, and abroad, the difficulty is still greater. If foreign Governments, which have a great many good stallions, could for the future be induced to send some to the Show-yard, a display equal, if not superior to our own, might lend its attraction to the Exhibition; for at no time has the thoroughbred horse been more in request on the Continent than at present."

Mr. Barthropp undertook the classes of Agricultural and Working Horses. "The show of horses," he says, "on the whole was most excellent. Although in the department with which I was concerned some of the classes were not well filled, many good animals were exhibited, and some that would have



held their own in many a Show-field in England. The first class, for Suffolk stallions, comprised 'Boxer,' the first-prize two-year old at Battersea; but he had not improved with his year, and was only highly commended. Baron von Nathusius exhibited the well-known 'Marquis,' a twice-winner at our 'Royal'—his age, however, was against him on this occasion; and Mr. Wilson took the 1st prize with a good useful three-year old, who found a foreign purchaser. Mr. Crisp sent six two and three year old stallions, and obtained a 2nd prize for one of them: as a proof of how the breed is appreciated on the Continent, but one of these colts, I believe, returned to England!

"The Suffolk mares were more admired than the stallions—and justly so, being a better sample of the breed. That spirited agriculturist Baron von Nathusius showed a clever three-year old, which, however, was not quite good enough to beat Mr. Crisp, who had it all his own way in most of the classes in which he exhibited.

"In the next class of stallions, 'for other English or Scotch horses,' in which several good animals were shown, 'The Brewer,' from Yorkshire, beat the Clydesdales. Two very useful mares from the Shaw Farm at Windsor were the winners in the class of mares of the above breeds. The classes of 'Percheron' stallions and mares were not well filled: the winners were active animals, but, in my opinion, more fit for road-work than for agricultural purposes.

"The class for half-bred stallions comprised twenty animals of almost every description; and the sooner the majority are castrated the better it will be for their respective districts. Three or four of the horses were good *in themselves*; but it must be a great lottery to breed from such decided crosses; and they appeared much more calculated to draw a diligence than a plough or harrow.

"The mares in the corresponding class were much better; and many of them, if put to a good thoroughbred horse, would produce good hunters.

"The Jutland horses were bad.

"The class of three and four-year old geldings contained several nice, clever colts; but they were thought too light for agricultural purposes, and the prizes were withheld. The same may be said of a class for one and two-year old entire colts, in which twenty-three were entered, many of them being by thoroughbred horses, and consequently more fit for hunting than for farm-work.

"The 1st and 2nd prizes for pairs of mares for agricultural purposes were taken by Mr. Crisp, who had no difficulty in dis-

tancing his three competitors. The arrangements and the accommodation of the show were excellent, but the classification wanted a little revision, as the exhibiting of yearling against two-year old colts, and three against four-year-olds, was hardly fair. Nevertheless the meeting as a whole was most satisfactory; and it is to be hoped that it will be the forerunner of many such gatherings, to the mutual advantage of both British and foreign breeders."

Mr. R. Smith has favoured me with the following remarks on the Cattle and Sheep Classes, of both of which Juries he was a member:—

"**CATTLE.**—There were some first-class specimens among the Bulls, such as 'First Fruits,' 'Gamester,' and 'Lord Lovell.' They were constantly surrounded by foreign inquirers, and must have left their mark upon the foreign mind. Lord Kinnaird's bull, 'Honey-dew,' famous in the North, showed great merit; he is a massive, well-formed animal of fair quality. Amongst the short-horns bred on the Continent were two prize bulls and a heifer, descended from the Townley herd.

"The Ayrshires were by no means good; but there were some good specimens of the Galloway breed, which sold readily and at high prices. They were chiefly from Forfarshire. The most prominent was Mr. D. Smith's (Leyshade) old bull; Mr. Stewart's heifers, from Aberdeen, were also very choice.

"The French Charolaise breed was scarcely represented, and offered nothing remarkable.

"The Continental breeds were of much the same order, but not so good a selection, as appeared at Battersea. Their enumeration would not avail much. Some of them had been bred from English bulls; and these were easily distinguished from their leaner brethren. The most remarkable cross was from a short-horn cow and a Zebu bull; another of a similar kind, was from a Zebu cow by an Ayrshire bull.

"The most striking feature of the foreign section of the Show was presented by the working-oxen, which were shown in very picturesque harness. They were of immense size, and often represented a cross from English breeds, especially the Sussex and Devon.

"The sale department of the Meeting was successful. Besides a clearance of nearly all the English South Down and Cotswold sheep, of some few Lincolns and Leicesters, of all the Galloway cattle, and of lots of pigs, Lord Walsingham sold his second-prize bull, 'Lord Lovell,' and Mr. Crisp his 'Gamester,' while 'First Fruits' was purchased by a company in the neighbourhood of Tonning, to be used by subscription. Several hundred Downs

and other ewes were sold by salesmen and dealers. Four Scots, bred by Mr. T. Lyell, fetched 500 guineas. One person invested 2000*l.* in stock for sale at the Show.

"The pigs were numerous, and in many respects good. Messrs. Crisp and Sexton won many prizes, and sold their animals at high and remunerating prices. A large sale was effected in this department.

"The Exhibition may be fairly reckoned as a success; but a few alterations in the arrangements might be adopted with advantage. Difficulties arose from the British-bred sheep being mixed up with the same breeds produced on the Continent; from the sheep, in and out of their wool, competing together; and from the exhibition of animals of different ages in one class, which gave an undue advantage to the older ones, unless extra care and judgment were displayed by the Jury.

"A compliment was paid to the Judges by placing in their hands a printed catalogue containing the entries and address of each exhibitor; but the English plan, of entering *the numbers only* in the Judge's book is, we think, preferable.

"The plan of the prize-cards might be improved at any subsequent Show. Instead of cards printed in *small type* placed under the loose canvas which covered the sheds, at the highest part of the shedding where no one could read them, different coloured cards, legibly printed, and placed in a readable position, might be substituted with advantage.

"Champion prizes for the best male and female of different breeds, as given at the English International Meeting at Battersea, would also be a valuable addition to the prize-list.

"SHEEP.—The Sheep consisted of a great variety of form and breed, some kinds being well represented. In each class, animals of all ages were exhibited: the rams of one year old not being as in England, distinguished from those of greater age. This arrangement proved very inconvenient, and gave the Judges considerable difficulty in comparing the merits of sheep of different ages.

"*The Merinos*, which held the first place in the Catalogue, were put into two classes, according as their wool was fine, or of coarser quality. The former comprised 165 rams and 103 pens of 3 ewes,—the latter, 324 rams and 323 pens of 3 ewes. This was the largest exhibition of Merinos ever held, and contained many excellent specimens; an increase of size and an increasing weight of wool were observable, effected probably either by careful selection of the animals bred from, or by a distant connexion with some other breed. In many specimens the experienced hand likewise detected a decided improvement both in

the quality and quantity of the flesh. It is a question of some importance whether the breeders of the Merino should confine themselves to the production of wool alone, or endeavour to obtain a more profitable carcase at the same time.

“*The South-Downs.*—The purchase of Lord Walsingham’s best ram for 100 guineas by Baron von Magnus of Saxony, and the high price given by Herr Hedengren, on behalf of the Swedish Government, for the second-prize sheep, besides other sales, show how much these International Exhibitions remove prejudice. The following figures testify to the foreign estimation of the South-Down :—

	Guineas.
First prize yearling ram was sold for .. ..	100
Second .. ..	50
Second .. .. at Yarmouth .. ..	60
No. 18 .. ..	40
Shearling .. ..	46½
Little sheep .. ..	35
Nine shearling ewes .. ..	80

Lord Walsingham’s three unsold sheep had more than average merit: 80 guineas was refused for one. Good specimens of the Babraham flock were exhibited by Mr. Taylor, of Harptree Court, Somerset, who refused 30 guineas for his three commended shearling ewes. Mr. Gebhard, of London, exhibited, as specimens from the Goodwood flock, some well-made ewes of good character and quality.

“The Judges experienced considerable difficulty, particularly in one case, from the circumstance that some of the animals appeared in the wool while the rest were shorn. The effects of the heat and fatigue of travelling also told unfavourably on the looks of some, more especially those in their wool. Lord Walsingham lost a ram worth 70 guineas; Mr. Crisp another; and Mr. Taylor his best pure-bred Babraham yearling ram (brother to the prize ewes) before the prizes were awarded. A brother to the last-named ram was sold at a high figure to a Continental breeder. The Duke of Richmond’s ewes, and others of Messrs. Crisp and Sexton, sold well. Of the South-Downs bred on the Continent, those exhibited by G. Zöpplitz, Wurtemberg, Baron von Nathusius, and Baron von Magnus of Drehsa, may be mentioned as specimens of the most successful flocks. They are descended from the Babraham sheep, and were fair specimens; others had much deteriorated, some exhibitors having had no previous opportunity of knowing what an *English* South-Down ought to be. This International Meeting having shown the true type of animal, an increase in the foreign trade may be fairly anticipated.

“*Short-Woolled Breeds from Great Britain.*—These prizes were



fairly contested. Mr. Guerrier's (London) Oxford Down was of good form and quality; and the second-prize West-Country Down, bred by Mr. Humphrey, Oak Ash, Berks, a very fair specimen. Some good animals were also exhibited by Mr. Druce, of Eynsham; but, as they possessed heavy fleeces, my colleagues gave the preference to those animals which had more of the Down character.

"There were only three entries for short-woolled ewes, not being South-Downs; but these were sufficient representatives of their class.

"The Leicesters from England and Scotland were fair specimens. Mr. Groves (Kirk Hammerton Lodge, Yorkshire) obtained the first prize and an honourable mention with some good animals. Lord Kinnaird's sheep were of a useful kind; his Leicester ewes distanced all competitors: they were descendants of the old flock from Burley-on-the-Hill, and had kept their quality and form well up to the good age of five and six shear ewes.

"The Leicesters bred on the Continent were moderate sheep, by no means approaching the English Leicester, but the prizes were distributed for encouragement.

"*Lincolns Bred in England.*—All the prizes in this class would have gone to the flock of Mr. Marshall (Branston, Lincoln) but for the foreign Judges' prejudice against heavy fleeces; however, as the English judge, I insisted upon Mr. Marshall's shearling receiving the first prize; and the second was awarded to Mr. J. Clarke, of Long Sutton. Mr. Marshall's two-shear was placed third, and his ram-hogs, with fleeces of lustre-wool of at least 20 lbs. each, were highly commended.

"There were some splendid specimens among the sheep shown from the Branston flock. Mr. Clarke's sheep were also good, especially his prize ram, which had a fair form, with good quality of wool and mutton. The first and second prize shearling ewes were also good animals.

"*Cotswolds Bred in England.*—This breed was well represented, some being sent to compete for the prizes, and some for sale. Mr. Handy's first prize was a splendid old sheep: it is a question whether it is advisable to send so fat an animal such a distance. Mr. Garne's sheep were worthy of notice, and Mr. Sexton's three shearlings were much admired. The ewes were some of them fair specimens; Mr. H. Gebhard's were of a useful kind. Many Cotswolds were sold to foreign buyers.

"*Long-woolled Sheep of a Continental Race.*—These were chiefly from the marsh-lands of Holstein, with a few from Hanover. The Holstein race is a large breed, standing very high, remarkable for its prolific character, as the following in-

stance, quoted from the Catalogue as the entry of M. Dohrn, Dammfleth, Wilstermarsch, Holstein, will testify :—

1 ewe	..	..	5 lambs	..	..	3 years old.
1	..	..	4	..	..	..
5 ewes	..	..	3	..	each	..

A produce of twenty-four lambs from seven ewes must be worthy the notice of the Acclimatization Society! M. Dohrn purchased two Cotswolds for crossing this race, to introduce a more meat-producing element.

“Nearly every form, colour, and class of wool that could be thought of was represented in the other classes for foreign sheep, some being with and some without horns. Many of the breeds might be improved by an infusion of English blood; but great care would then be required to maintain the family characteristics of the Continental breed. There were some interesting Cross-bred classes showing a profitable return. In one instance the Cotswold ram and a Merino ewe had produced a prodigious animal, with fair wool and feeding qualities. Baron von Nathusius sent specimens of the crosses termed Cotswold-Merino, South-Down Merino, and Leicester-Merino, some of them capital animals. There was also a good-looking sheep, termed Dishley-Merino, another Lincoln-Velmoe. These results will aid in extending the international element and the market for English rams.

“The average live-weight of the three shearling ewes, as shown in the different classes, and weighed for record at my suggestion, was as follows :—

	Hamburg lbs.
Lord Walsingham's prize Southdowns	167 each
Mr. Zöppritz's prize Southdowns, bred on the Continent	155 ..
Mr. Humphrey's West Country Downs	169 ..
Mr. Smith's (Hull) Leicesters	164 ..
Mr. Marshall's Lincolns	260 ..
Mr. Gibson's Cotswolds	192 ..
Mr. Dohrn's Holstein Ewes (with 5 lambs)	200 ..
.. 5 lambs	84 ..

“The above are stated in New Hamburg weight, 100 lbs. of which are equal to 107 lbs. English. This testing of the weights affords a useful check and verification when a doubt exists whether sheep have been fairly shorn, and places *substance* in its proper position.

“Mr. Marshall exhibited, in the Section of Agricultural Products, five fleeces of wool, which were minutely inspected by the authorities, and thus noticed :—

“Three Lincoln hog fleeces, very fine, each 17 lbs. (Hamburg). Two fleeces from two-years old sheep, heavy and good, each 19 lbs. The length of the staple upon the ram-hogs shown

in the classes was 18 inches, in broad locks of a bright, rich, yellow-lustre caste.”

**MACHINERY AND IMPLEMENT DEPARTMENT.**—In this department the only money prizes were given to the Steam-Plough competitors; to all other successful exhibitors the awards were made in Medals in Gold, Silver, and Bronze.

The Steam-Plough competition took place under the most unsatisfactory conditions; indeed it would have been well-nigh impossible to have selected a piece of ground less suited to exhibit the great advantages which it possesses, as regards both economy and excellence of work. The fault of selection, however, was not that of the Executive Committee, as, although every exertion was made by them, it was found impossible, owing to the nature and the occupation of the surface round the city, to obtain any other land, within a convenient distance, sufficiently large for the purposes of the trial. The costs the Committee were called upon to incur, for the temporary occupation and use even of this unsuitable land, were at the rate of about 25*l.* per acre. There were four competitors for the prizes—Messrs. Fowler and J. and F. Howard, who exhibited their well-known respective methods of Steam Cultivation; and Messrs. Ransome and Sims, and Richardson and Darley, who used modifications of Fowler’s arrangement. The 1st prize of 700 thalers (105*l.*) was awarded to Mr. Fowler, and the 2nd of 300 thalers (45*l.*) to Messrs. Howards for their different methods of applying steam-power to ploughs and the cultivation of the soil; and a “special” Gold Medal was given to each of the other competitors for their modifications of Fowler’s apparatus. The trials excited the greatest interest; and, notwithstanding the want of ready access to the ground, the spirited outlay of the Executive Committee was rewarded by a clear profit of 91*l.* from the proceeds of admission to the trial ground, although the expenses incurred for the land for these and the Reaping-machines’ trials had been 6177 marks = 368*l.* 15*s.* 6*d.*

The following awards of Medals were also made:—

**GOLD MEDAL.**—Messrs. Barrett, Exall, and Andrewes; Garrett and Son; J. and F. Howard; Ransome and Sims; Clayton and Shuttleworth; Hornsby and Sons.

**LARGE SILVER MEDAL.**—Messrs. B. Samuelson and Co.; Aveling and Porter; H. Clayton and Co.; E. R. and F. Turner; Woods and Cocksedge; A. C. Bamtell; C. Burrell; T. W. Ashby and Co.; Burgess and Key; W. N. Nicholson; E. H. Bentall; Priest and Woolnough; Coleman and Sons; Ruston, Procter, and Co.; Marshall, Sons and Co.

**SMALL SILVER MEDAL.**—Messrs. W. C. Cambridge; W. McClellan; R. and J. Linneker; W. Wilkinson; James Powis and Co.; Spear and Jackson;

Thompson and Avery ; Thomas Green and Son ; R. Boby ; Walter A. Woods ; Brigham and Bickerton ; Kemp, Murray, and Nicholson ; James Smith and Son.

LARGE BRONZE MEDAL.—Messrs. George Smith and Co. ; Stevens' Bread Machinery Company ; F. Helmsing and Co. ; John Goucher ; T. R. and R. Hunt ; Thomas Bradford ; G. W. Belding and Co. ; G. P. Dodge ; H. Puckering and Co. ; Doulton and Co. ; Webb and Son ; S. S. Wilkinson ; G. C. Scrulton ; W. Smith ; J. W. Barrow and Co. ; J. J. Porter and Co. ; G. Bower.

Considering the small amount of publicity given to the details of the proposed Show in this country, and considering also the inopportune time (for us) at which it was to be held, interfering so directly as it did with our own great annual Meeting at Worcester, the names and contributions given show clearly the interest taken by our breeders and machinists in such meetings, and their readiness to take part in them, even under the adverse circumstances as to the date at which the Hamburg Show was held.

The Meeting at Hamburg commenced on Tuesday, the 14th July, and our own Show-yard, at Worcester, was opened to the public on Wednesday, the 15th ; thus retaining at home, without doubt, not only many of our farmers and our engineers, but the cattle and the implements which would otherwise have added both to the number of the visitors and of the contributions to the great Meeting at Hamburg. This clashing between the great Meetings was unfortunate no doubt to both countries ; but, under the circumstances, it appears to have been unavoidable. It would have been unreasonable for us to expect that our interests and our convenience alone would be consulted in such an undertaking. To its success the German element was of more consequence and likely to contribute far more than the British ; and the period of the Meeting was determined accordingly.

In Northern and Eastern Germany horses and sheep form the most important features in stock-farming ;—in many of the countries on the Continent the former, indeed, come directly within the superintendence of the Government. The Show would have been deprived of its main features of interest and of benefit had these two classes of stock not been fully represented ; and this could not have been achieved had the period of the Meeting been fixed at either an earlier or later date. It appears that the Stud-Horses do not come in from the districts in which they are appointed to serve until the last week in June, after which a clear week was required to get them up into condition for the Show. On the other hand, it was most important that the Sheep should be exhibited in the wool, which the great flockmasters were unwilling, for obvious reasons, should remain, at that season, unshorn one day longer than was absolutely required by the circumstances



of the Show. Thus a fair and reasonable explanation is afforded of a circumstance which, at the time, was freely commented upon by our countrymen, and appeared to some as a mistake or an oversight.

The Show-ground was immediately outside the city gates, on a large open space known as the "Heiligengeistfeld," and adjoining the city of Altona. It was thus readily accessible from all parts of both cities. The accompanying ground-plan (p. 230), with its explanatory details, gives the mode of distribution of the space occupied by it, which amounted to 1,598,430 square feet (Hamburg), or 32.4 acres; the whole area being surrounded by a 10-foot deal fence.

This space was occupied as follows:—

	Square feet.
1. The entire horses in 11 sheds, covering* .. ..	16,200
2. Mares, mares with foals, other horses in 9 sheds ..	27,200
3. Bulls and cows in 25 sheds .. .. .	43,000
4. Sheep in 19½ sheds .. .. .	30,700
5. Pigs in 6½ sheds .. .. .	10,920
6. Poultry in 3 sheds .. .. .	2,750
7. Agricultural products in 6 sheds .. .. .	27,000
8. Machinery and implements in 12 sheds .. ..	48,000
9. Machines, &c., in motion .. .. .	167,082
10. Flower-show, 2 sheds .. .. .	9,720
11. Offices of Executive Committee .. .. .	4,830
12. Restaurateurs and retiring rooms .. .. .	19,250
13. Refreshment tents, 4 .. .. .	8,000
14. Music pavilion .. .. .	625
15. Photographic department .. .. .	1,500
16. Water-closets, 6 .. .. .	1,500
17. Ring for horses .. .. .	26,376
18. Sheds for forage, litter, &c. .. .. .	5,000
19. „ corn for threshing .. .. .	5,125
20. „ coals .. .. .	4,038
21. Store-sheds for cattle classes .. .. .	3,850
22. Sheds for machinery .. .. .	15,500
25. Stalls for sick cattle .. .. .	300
26. Wood-stores .. .. .	2,774
27. Engineer's offices .. .. .	900
Total space covered .. .. .	482,140
Leaving free for the public .. .. .	1,116,290
Total area enclosed .. .. .	1,598,430

The prices for admission were as follows:—The first day, July 14th (10 marks), 11s. 10d.; the 15th, 16th, 17th, and 18th (1 thaler), 3s.; the 19th (Sunday) (½ mark), 7d.; the 20th (1 mark),

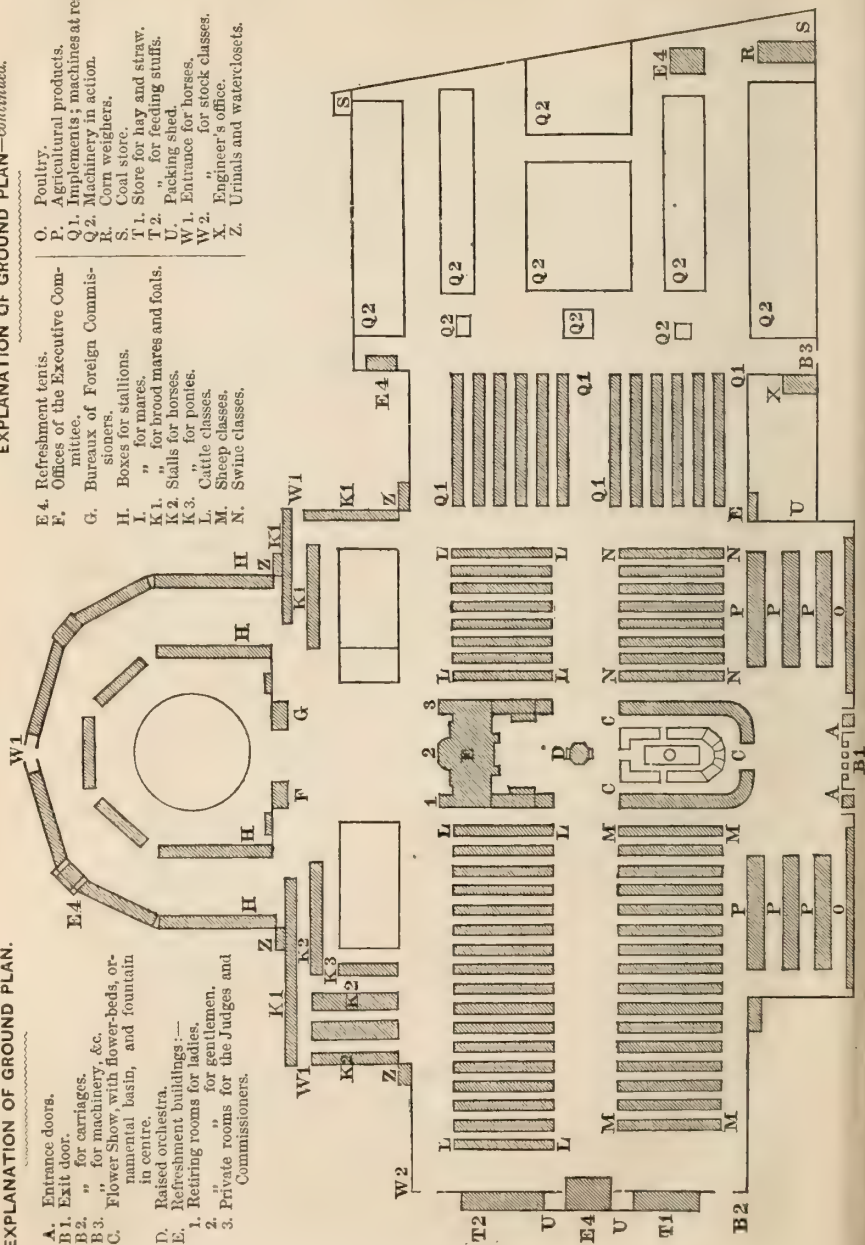
\* The figures given are in the Hamburg measurement, the difference between that and our own being but small; 100 square feet Hamburg are equal to 88.36 English measurement.

## EXPLANATION OF GROUND PLAN.

- A. Entrance doors.  
 B1. Exit door.  
 B2. " for carriages.  
 B3. " for machinery, &c.  
 C. Flower Show, with flower-beds, ornamental basin, and fountain in centre.  
 D. Raised orchestra.  
 E. Refreshment buildings:—  
 1. Retiring rooms for ladies.  
 2. " " for gentlemen.  
 3. Private rooms for the Judges and Commissioners.

## EXPLANATION OF GROUND PLAN—continued.

- E4. Refreshment tents.  
 F. Offices of the Executive Committee.  
 G. Bureaux of Foreign Commissioners.  
 H. Boxes for stallions.  
 I. " " for mares.  
 K1. " " for brood mares and foals.  
 K2. Stalls for horses.  
 K3. " " for ponies.  
 L. Cattle classes.  
 M. Sheep classes.  
 N. Swine classes.  
 O. Poultry.  
 P. Agricultural products.  
 Q1. Implements; machines at rest.  
 Q2. Machinery in action.  
 R. Corn weighers.  
 S. Coal store.  
 T1. Store for hay and straw.  
 T2. " " for feeding stuffs.  
 U. Packing shed.  
 W1. Entrance for horses.  
 W2. " " for stock classes.  
 X. Engineer's office.  
 Z. Urinals and waterclosets.



1s. 2d. ; 21st (1 thaler), 3s. ; 22nd and 23rd ( $\frac{1}{4}$  mark), 3½d. In addition to those who paid the above prices for admission at the gates, a large number of tickets (5168) were sold giving admission during the continuance of the Meeting. For these the charge was 15 marks each, or 18s.

The number of persons admitted each day by tickets and by payment at the gates was as follows :—

		By Admission Ticket.	By Payment.	Total.
July 14	.. ..	5,000	670	5,670
„ 15	.. ..	5,000	14,201	19,201
„ 16	.. ..	5,000	19,086	24,086
„ 17	.. ..	5,000	19,571	24,571
„ 18	.. ..	5,000	12,658	17,658
„ 19	.. ..	2,600	40,118	42,718
„ 20	.. ..	3,000	44,507	47,507
„ 21	.. ..	4,000	2,511	6,511
„ 22	.. ..	1,000	2,990	3,990
„ 23	.. ..	600	1,404	2,004
		<hr/> * 36,200	<hr/> 157,716	<hr/> 193,916

The Finance department, the most satisfactory test of the practical success of such undertakings, alone remains to be touched upon. This presents a most satisfactory and encouraging appearance; for although the total expenditure was no less than 296,685 marks, or 17,706*l.* sterling, the nett proceeds amounted to 376,615 marks, or = 22,457*l.* sterling, thus leaving a clear surplus of receipts over expenditure of 79,480 marks, or 4751*l.* sterling.

The several details of the *Expenditure* may be considered under the following heads :—

1. Prizes in Money, Cups, and Medals.
2. Costs of construction, decoration, &c.
3. Working expenses.
4. Expenses of foreign Jurors and guests.
5. Expenses of administration.
6. Sundry expenses, including music, printing, advertisements, &c. &c.
7. Surplus of receipts over expenditure.

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\* The numbers given of admissions by these tickets must be considered rather as an estimate than as being strictly correct, as the registration was very imperfect. At the same time it should be observed that the numbers given of admissions by payment are in all probability considerably below the correct amount, as great irregularities, on the part of the money takers in the admission department, were discovered at an early period of the meeting.

The several items of those expenses may be perhaps best given in a tabular form, as follows:—

1. *Prizes*:—

		Marks current.	£.
A. In money	.. .. .	*48,262½	= *2881·343
B. In cups	.. .. .	5,350	= 319·402
C. In medals	.. .. .	11,102½	= 662·835
			<hr/>
			3863·580

2. *Construction, &c.*:—

A. Buildings	.. .. .	95,168½	= 5681·716
B. Groundworks	.. .. .	4,966½	= 296·492
C. Decorations	.. .. .	7,755½	= 463·
D. Flower show	.. .. .	2,680½	= 160·044
E. Water supply and fittings	.. .. .	10,296	= 614·686
F. Lighting	.. .. .	418	= 24·955
			<hr/>
			7240·893

3. *Working Expenses*:—

A. Forage	.. .. .	13,963½	= 833·641
B. Coals	.. .. .	1,234½	= 73·716
C. Transport expenses	.. .. .	872½	= 52·089
D. Land for steam-plough trials	.. .. .	6,177	= 368·776
E. Fire insurance	.. .. .	640½	= 38·253
F. Police and fire-guard	.. .. .	3,757½	= 224·328
G. Small expenses	.. .. .	3,198	= 190·925
			<hr/>
			1781·728

4. <i>Expenses of sundry Jurors and guests</i>	.. ..	10,921½	= 662·044
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5. *Expenses of Administration*:—

A. Salaries, presents, &c.	.. .. .	28,939½	= 1727·716
B. Hire of offices	.. .. .	1,260	= 75·223
C. Stationery, &c.	.. .. .	866½	= 51·746
			<hr/>
			1854·685

6. *Sundry Expenses*:—

A. Music	.. .. .	1,800	= 107·462
B. Printing	.. .. .	23,513	= 1403·761
C. Advertisements	.. .. .	9,710½	= 579·731
D. Postage and telegrams	.. .. .	2,373	= 141·671
E. Bank commission and loss on Change	.. .. .	1,455½	= 86·880
			<hr/>
			2319·505

7. *Surplus*:—

A. Claims on sundry exhibitors for disburse- ments	.. .. .	1,475½	= 88·089
B. Cash	.. .. .	78,005½	= 4657·044
			<hr/>
			4745·133

\* In these tables the pound sterling is calculated at 16·75 marks, the rate of exchange at the time.



The *Receipts* may be tabulated under the following heads:—

1. For admissions to Show.
2. Entry-fees for Stock, &c.
3. Rent.
4. From sundry sources.

The details are as follows:—

1. *Personal Admissions*:—

	Marks.	£.
A. Tickets for the meeting .. .. .	77,520	= 4,628·059
*B. Cash taken at the doors .. .. .	242,407	= 14,472·059
C. Taken at steam plough and reaper trials ..	7,708½	= 460·208
D. For catalogues .. .. .	16,343	= 975·716
		<hr/> 20,536·042

2. *Entry Fees*:—

	Thalers.	£.
A. For machinery, &c. .. .. .	4,047	= 607·05
B. Stock .. .. .	4,157½	= 623·625
C. Products .. .. .	1,150	= 172·5
		<hr/> 1403·175

3. *Rent*:—

	Marks current.	£.
A. From restaurateurs .. .. .	4,000	= 238·805
B. 4 refreshment tents .. .. .	1,200	= 71·641
C. Photographic atelier .. .. .	125	= 7·462
		<hr/> 317·908

4. *Sundry Sources*:—

A. Commission on auction sales .. .. .	1,362½	= 81·343
B. Sale of manure .. .. .	515½	= 30·776
C. „ surplus coals .. .. .	1,344¾	= 80·283
D. Interest on balances .. .. .	253½	= 15·134
		<hr/> 207·536

Such are the details of the International Agricultural Meeting at Hamburg, an undertaking as creditable to those who organised and conducted it as it was satisfactory to those who attended

	£.
* On the 14th .. .. .	400·000
„ 15th .. .. .	2119·552
„ 16th .. .. .	2848·656
„ 17th .. .. .	2921·044
„ 18th .. .. .	1889·253
„ 19th .. .. .	1197·552
„ 20th .. .. .	2657·134
„ 21st .. .. .	374·776
„ 22nd .. .. .	44·626
„ 23rd .. .. .	19·462
	<hr/> 14,472·055

it, whether as exhibitors or merely visitors. The benefit, too, to the country in whose interests it was mainly undertaken, cannot well be overrated. The numbers who came from distant parts to see it, in spite of the unfavourable, nay inclement, weather during the entire period of the Show, testify to the interest it excited, and to the sound judgment and discrimination of the Executive Committee, who had recognised and supplied a requirement of German agriculture.

Under even the unfavourable circumstances of a first attempt, of bad weather, and of the unforeseen and lamentable loss which the Committee sustained on the very eve of the Meeting by the death of its President,\* its success was beyond all expectation. Let us hope, in the interest of agriculture generally, that a festival which has been so successfully inaugurated may be perpetuated—that we may at no very distant day be again invited to take part in another International gathering on the same ground; when I feel certain that the good results of the last will secure even a greater proportion of exhibitors from Great Britain than were then present, creditable though that proportion was.

JOHN WILSON.

IX.—PROFESSOR VOELCKER's *Annual Report*. 1. *Adulteration of Oilcake*; 2. *Of Artificial Manures*; 3. *Analysis of Egyptian Guano*; 4. *Of Nile-water*; 5. *Causes of Barrenness in Soils*; 6. *Subjects recently under Investigation*.

IN my last annual Report I directed attention to the enormous extent to which oilcakes, professedly sold as genuine, were mixed with cheap refuse feeding-materials, or with more or less unwholesome foreign impurities, imported with the seed from which such cakes were made.

1. At the request of the Council I delivered a lecture before the Society on the subject of cake adulteration, which appears to have attracted considerable attention in the agricultural and commercial community, and I have now the satisfaction to report that a great improvement has taken place in the manufacture of oilcakes. Amongst the samples sent for examination during the past season, comparatively speaking, few were found to be grossly adulterated or absolutely injurious to cattle, and a large proportion were what they professed to be, pure genuine linseed-cakes

\* On the death of Baron Ernst Merck the Presidency of the Executive Committee devolved upon Mr. Aug. Jos. Schön, under whose able management, aided by the personal exertions of his colleagues, the Meeting was conducted to such a successful termination. To this gentleman I am indebted for the statistical details given in this Report.

of superior quality. Still, however, inferior and more or less impure cakes find their way into the hands of the agriculturist; and continued vigilance on the part of the purchaser is still desirable, in order to put the trade in oilcakes into a healthy condition. A step in the right direction has lately been taken by the seed-crushers themselves, who, to check seed-importers in the practice of mixing linseed with worthless and often injurious weed-seeds before it reaches the shores of England, have organized a plan which will secure the importation of linseed, containing not more than 5 or 6 per cent. of foreign impurities. Little or no difficulty may therefore be expected in procuring pure linseed-cakes, provided a fair remunerative price is paid for them.

The best cakes examined by me this season were of English make, stamped "Pure." Almost equal to them I found several samples of Marseilles cake. The latter, however, though pure and superior to the generality of English cake, are, as a rule, not quite so good as the best English or American, inasmuch as they are too hard pressed, and, consequently, rather deficient in oil. For store stock, on the other hand, they will be found an economical food on account of their moderate price. In buying this cake, care should be taken to select good samples, inasmuch as it is frequently mixed with nut-cake.

Decorticated cotton-cake, which is only made in America, is now seldom seen in the market, and its place is now taken almost entirely by whole-seed cake of English make. In former years, cases of so-called poisoning with cotton-cake were frequently brought under my notice; in the past season only three or four instances of the injurious effects from its use were referred to me: from this it may be inferred that English cotton-cake is now generally sold in a better condition than formerly. This, indeed, is the case. Having failed to detect an essentially poisonous matter in any of the cotton-cakes, which, nevertheless, unquestionably had an injurious, and, in many cases, fatal effect upon the animals to which they were given, I looked closely into this matter, and learned that the injury to cattle was produced by the hard, indigestible, and badly comminuted husk. My suggestion to remove a portion of the coarser husk by screening, and to reduce the remainder into a tolerably fine powder, has been adopted by several makers, who have thus removed the chief defects that characterize all cakes in which the husk may be seen in large fragments. Inferior cake has always a brownish colour, instead of a more greenish-yellow appearance.

2. The lecture on Manure Experiments on Grass-land delivered by me last May has led to an extended correspondence, and elicited many inquiries from members of the Society, affording an

indication that the improvement of grass-land is now receiving a greater share of attention than formerly.

It is with satisfaction that I have to report that the adulteration of artificial manures is decreasing from year to year. Few samples of Peruvian guano are now found to be adulterated, and superphosphate of lime and similar fertilizers are generally sold in a better condition and of higher intrinsic value than in former years.

3. A new description of guano was recently sent me for examination from Egypt.

Two samples were found on analysis to contain in 100 parts :

	No. 1.	No. 2.
Moisture .. .. .	17.19	15.06
*Organic matter and salts of ammonia .. .. .	39.50	39.30
Phosphates of lime and magnesia (bone-earth) ..	18.28	19.89
Sulphate of lime .. .. .	2.76	3.15
Alkaline salts (chiefly chloride of sodium) ..	20.93	20.39
Insoluble siliceous matter .. .. .	1.34	2.21
	<hr/> 100.00	<hr/> 100.00
*Containing nitrogen .. .. .	11.81	10.93
Equal to ammonia .. .. .	13.97	13.27

Though not equal to Peruvian guano, these two samples are very valuable, and richer in nitrogenized organic matters than most other varieties of guano and artificial manures. Whether this guano is found in large quantities or not, and is likely to be imported into England, I have not as yet been able to ascertain.

4. The Government of Egypt for some time past has actively encouraged agricultural improvements. In the course of an investigation into the agricultural resources of that country, specimens of Nile-water were lately sent to me, that I might endeavour to determine the causes of the remarkable fertilizing effects which it produces, and to ascertain at what period of the rise of the Nile the water is most valuable as a fertilizer.

The first specimen was taken at the beginning of the rise, and on examination was found to contain, in an imperial gallon,—

	Grains.
Suspended matter .. .. .	23.83
Soluble matter .. .. .	17.87

The suspended matter, it will be seen, amounts to more than the matter held in solution. It was found to consist of:

	Grains.
Mineral substances (fine clay and sand) .. ..	20.89
*Organic matter .. .. .	2.94
	<hr/> 23.83
*Containing nitrogen .. .. .	11
Equal to ammonia .. .. .	13



The clear filtered water left on evaporation, when dried at 300° Fahrenheit, 17·87 grains of dry residue, which, on analysis, produced :

Organic matter	..	..	..	..	..	..	..	2·12
Oxides of iron and alumina, with traces of phosphoric acid								·07
Silicate of lime	..	..	..	..	..	..	..	1·85
Carbonate of lime	..	..	..	..	..	..	..	4·36
Carbonate of magnesia	..	..	..	..	..	..	..	2·81
Carbonate of potash	..	..	..	..	..	..	..	·66
Carbonate of soda	..	..	..	..	..	..	..	3·26
Chloride of sodium	..	..	..	..	..	..	..	2·30
Sulphate of potash	..	..	..	..	..	..	..	·93
Nitrate of potash	..	..	..	..	..	..	..	·18

The proportion of soluble matters in this specimen of Nile-water, it will be seen, is very trifling. On the other hand, it contains a good deal of carbonate of soda and magnesia. When filtered, and deprived thereby of its sediment, which appears to be mainly instrumental in renewing the fertility of the land, Nile-water is wholesome and agreeable to the taste.

The second specimen of Nile-water was taken at the height of the flood, and distinguished from the first sample by a bright, almost blood-red colour.

On standing for a considerable length of time it lost its colour, and deposited per imperial gallon, 87·51 grains of solid matter, which consisted of—

Mineral substances (extremely fine clay and sand, containing a great deal of oxide of iron)	..	..	..	..	..	..	..	81·66
*Organic matters	..	..	..	..	..	..	..	5·85
								87·51
*Containing nitrogen	..	..	..	..	..	..	..	·26
Equal to ammonia	..	..	..	..	..	..	..	·31

The filtered and clear water on evaporation and drying at 300° Fahr., furnished 11·88 grains of solid residue per imperial gallon. This residue, on analysis, yielded—

Organic matter	..	..	..	..	..	..	..	1·54
Oxides of iron and alumina, with traces of phosphoric acid								1·04
Carbonate of lime	..	..	..	..	..	..	..	1·41
Silicate of lime	..	..	..	..	..	..	..	3·87
Sulphate of lime	..	..	..	..	..	..	..	1·32
Chloride of sodium	..	..	..	..	..	..	..	·79
Carbonate of soda	..	..	..	..	..	..	..	·48
Nitrate of potash	..	..	..	..	..	..	..	·84
Carbonate of magnesia	..	..	..	..	..	..	..	1·15

The red colour of this Nile-water I find not to be due to organic matter, but to extremely finely-divided oxide of iron. This red peroxide remains in suspension for weeks together, and thus imparts a bright red colour to the water.

There is a good deal of difference in the composition of Nile-water taken at the beginning and at the height of the flood. In the latter stage the suspended matter is nearly four times as large as at the beginning of the rise. On the other hand, the amount of soluble matter is a good deal less. The decrease of soluble organic matter in the second specimen is very remarkable, and as there is much more nitrate of potash in the water at the height of the flood, it would appear that the nitrogenous organic matter is rapidly converted into nitric acid, which, uniting with potash, forms nitrate of potash, a constituent which has been discovered before in Nile-water, but, as far as I know, not quantitatively determined.

Although the soluble saline constituents which are present in this and other waters used for irrigation contribute to their fertilizing properties, in the case of Nile-water it is chiefly the suspended matter which produces the well-known and astonishing effects upon vegetation. In this suspended matter we have both mineral and organic matters in a highly divided and most effective condition. If it be remembered that the second specimen of water contained a quantity of suspended organic matter, which on decomposition furnishes 3-10ths per cent. of ammonia in round numbers, and that, consequently, every 1000 gallons, in addition to an enormous quantity of mineral food for plants, contain an amount of organic matter in suspension which, when deposited on the land, will gradually generate no less than 300 lbs. of ammonia, no surprise will be felt at the results practically obtained in the irrigated districts of Egypt.

My object in relating some of the details which were brought to light in the course of my examination of Nile-water, is to direct the attention of the English farmers to the benefits which are in most cases likely to result from a good system of irrigation. It is well known that some waters are better adapted for irrigating purposes than others; but our information on the particular circumstances which determine their relative value is very limited. This subject is well worth a careful and extended chemical investigation.

5. For some time past my attention has been directed to an examination into the causes of that barrenness which characterizes some soils, and the great fertility which distinguishes others. Several soils have lately been examined by me, which were almost completely barren, and yet neither in their texture nor any other physical characteristic presented any indication that marked them as such.

Some important results have been obtained already, and others may perhaps follow on further pursuing this inquiry.

6. In addition to the usual analytical work for members of the Society, and the investigation to which reference has been made in the preceding observations, the following experiments were carried on by me during the past season:—

1. On Milk and Dairy-management:—

On this subject, and on the composition of annatto, papers, embodying the results of my investigations, appeared in the last number of the Journal.

2. On the Solubility of Phosphatic Materials in Water and Saline Liquids:—

The results of this investigation are ready for publication, and will form the subject of a paper in a future number of the Journal.

3. On the means of preserving and rendering more efficient the Fertilizing Constituents of Peruvian Guano:—

A paper on the subject will be found in the present number of the Journal.

4. Experiments with Nitrate of Soda on the Wheat-crop:—

The results of these experiments fully confirm the favourable opinions which I expressed in former communications of nitrate of soda, when judiciously used as a top-dressing for wheat. Thus, in one experiment, the produce of the land not top-dressed was  $38\frac{1}{2}$  bushels of wheat, and that of land top-dressed, at the rate of 2 cwt. of nitrate of soda and 4 cwt. of salt per acre, was  $49\frac{1}{2}$  bushels.

The application of nitrate of soda, in conformity with the results obtained in previous years, increased the yield of both grain and straw.

5. Experiments with Salt on Mangold; Swedes and Turnips; Wheat:—

The crop of Swedes and turnips were such failures that no satisfactory conclusion can be drawn from the experiments. In the Mangold crop, when grown on heavy land, no effect was observable, but on light sandy soil, a beneficial result followed from the use of salt. Applied to wheat, it decidedly checked the development of the leaf and stem; but whilst less straw was obtained from land so top-dressed, the yield of grain was neither diminished nor increased.

AUGUSTUS VOELCKER.

12, *Hanover Square, London,*  
*December, 1863.*

*Analyses made for Members of the Royal Agricultural Society,  
January to December, 1863.*

Guano .. .. .	40
Superphosphates and similar artificial manures .. ..	64
Nitrate of soda and salts of ammonia .. .. .	25
Refuse manures .. .. .	29
Bone-dust .. .. .	24
Limestones and marls .. .. .	37
Soils .. .. .	28
Waters .. .. .	10
Oilcakes .. .. .	91
Feeding-meals and vegetable productions .. .. .	10
Examinations for poison .. .. .	5

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### X.—*Salt Experiments and Mangolds.* By Dr. AUGUSTUS VOELCKER.

COMMON salt has been employed in all ages and in all countries for the purpose of promoting the growth of cereal and leguminous crops, grass, and roots—in short, every description of agricultural produce.

It has, moreover, been specially recommended, by experienced and intelligent farmers, as a most useful accessory manure for the mangold crop. On the strength of their testimony it must be admitted that salt has proved of much utility to mangolds in many instances, yet we must be prepared to meet with others in which it is certainly useless, and may even be hurtful.

When facts appear to contradict each other, it is of no avail to deny the validity of practical evidence, or to accept only those facts as true which agree best with our individual experience; we must rather try to gather information from our failures, as well as from successful experiments. In common agricultural life an experiment with this or that manure by which a considerable increase in the crop is obtained is characterised as a success; but if unattended by such increase, as a failure: whereas, in reality, such a success is often rather a failure. For, in a more philosophical sense, experiments are really successful only when they teach something that can be clearly recognised as an abiding lesson either for warning or for imitation. Upon the accumulation of a mass of such well-ascertained facts, our ultimate object, namely the establishment of general principles applicable to agriculture, must depend.

In this more philosophical sense, it must be confessed that we do not possess many successful agricultural experiments with salt. It has, perhaps, been tried more extensively and under a greater variety of circumstances than any other fertilizer, and yet in



general no better answer can be given to the inquiry "What have we learned from these trials?" than simply this: "in some cases salt did good—and in others, not." Such a reply clearly can be no guide for successful applications in future.

Impressed with the reputation which salt has gained as a manure for mangolds, I tried some experiments in 1862 in the hope of ascertaining the quantities which might be used to the best advantage. In recording the results of these and similar experiments, I consider it very important that the physical and chemical properties of the soil should be described as carefully as possible. Observations on a large scale have convinced me that the nature of the soil has a great deal to do with the success or failure in all cases where salt is tried as a manure.

The field in which the experiments were tried was in excellent condition, both as regards manuring and mechanical working. It bore clover in 1860, and a good crop of wheat in 1861. It received a good dressing of dung in the autumn of 1861, and was in capital order when the mangolds were sown in 1862. The soil was a calcareous clay, containing no sand, and a sufficient amount of clay to render it decidedly heavy and difficult to work in wet weather. The subsoil on which it rests is stiff clay. A portion of the soil, taken from a large sample removed from different parts of the field, was submitted to analysis, and the following results obtained:—

*Composition of Soil from Experimental Mangold-field of the Royal Agricultural College Farm, Cirencester.*

Moisture (when analysed)	..	..	..	..	..	4·710
Organic matter and water of combination	..	..				10·022
Oxides of iron and alumina	..	..	..	..	..	15·602
Carbonate of lime	..	..	..	..	..	16·448
Sulphate of lime	..	..	..	..	..	·375
Phosphoric acid	..	..	..	..	..	·072
Carbonate of magnesia	..	..	..	..	..	·798
Potash	..	..	..	..	..	·832
Soda	..	..	..	..	..	·098
Insoluble siliceous matter (clay)	..	·	..	..	..	50·787
						<hr/> 99·744

It will be seen that clay is the preponderating constituent of this soil, which contains also a considerable proportion of carbonate of lime.

Nine plots of 1-20th of an acre were selected for the experiments from the most even part of the mangold-field. The mangolds grew vigorously where the salt was sown by hand along both sides of the drills on the 29th of July. Each plot consisted of four drills. One plot received no salt; the eight others were dressed at the rate of from 1 to 8 cwts. of common salt per acre. The roots were counted and carefully weighed after cleaning and dressing.

The following Table shows the results that were obtained :—

EXPERIMENTS WITH SALT UPON MANGOLDS (ORANGE GLOBE).

Plots of $\frac{1}{20}$ Acre.	Salt applied per Acre.	Number of Roots per Plot.	Produce per Plot.			Produce per Acre.		
	cwts.		Cwts.	qrs.	lbs.	Tons.	cwts.	lbs.
No. 1	1	482	16	3	8	16	13	48
„ 2	2	516	16	0	23	16	4	12
„ 3	3	498	14	2	21	14	13	4
„ 4	4	517	14	3	17	14	15	4
„ 5	Nothing	497	15	0	12	15	2	16
„ 6	5	546	18	0	27	18	4	92
„ 7	6	480	16	2	13	16	12	36
„ 8	7	502	14	1	19	14	8	44
„ 9	8	515	14	3	25	14	16	52

These experiments, it must be confessed, are not calculated to demonstrate the utility of salt as a manure for mangolds.

On four plots the produce was actually slightly lower than on the plot not dressed with salt, and, omitting plot No. 6, the increase in the crop on three plots was but inconsiderable.

The result obtained on plot No. 6 is evidently exceptional, the much larger number of roots grown on this plot having, no doubt, affected the product. It is likewise possible that more farmyard-manure may have been accidentally dropped here than on other portions of the experimental field. In all probability, the differences in the amount of produce of all the nine plots are rather due to the difficulty of distributing farmyard-manure uniformly, and to the natural variations in the productive powers of the different parts of the field, than to the use of salt.

Whatever may be the cause of the variations in the produce, salt evidently did not produce a decidedly beneficial effect upon the mangold-crop.

All the roots of each plot were carefully weighed, and it is incumbent on the experimenter faithfully to record the results, though they may present discrepancies for which an explanation cannot be given.

In conclusion, it is well to bear in mind that the soil of the experimental field was a stiffish calcareous clay. On land of that character, common salt, if I am not mistaken, seldom produces any good effect; whilst on light sandy soils, if my experience teaches me true, it is generally applied with great success. It would, therefore, be wrong to say in a general way that salt is of no use to mangolds; all that can be said with propriety is, that in the preceding experiments it did not produce a decidedly beneficial effect upon that crop.

12, *Hanover Square, London (W.), February, 1864.*

# *XI.—Statistics of Live Stock for Consumption in the Metropolis.*

By ROBERT HERBERT.

DURING the last six months of 1863, the metropolitan cattle-market was somewhat heavily supplied with beasts, which with few exceptions came to hand in excellent condition, and met a ready sale at steady prices. The past may be considered as one of the most successful, if not the most profitable, seasons on record for the production of fat stock, as regards both England and Scotland, but in the beasts derived from Ireland no improvement has been apparent, and they have therefore changed hands heavily at moderate rates, notwithstanding that only 11,280 beasts were received from that quarter, against 14,820 in the corresponding period in 1862, and 14,340 in 1861. The supply from Lincolnshire, Leicestershire, and Northamptonshire comprised 66,510 head; being a slight falling off compared with the previous year. From various other counties, exclusive of the eastern districts, 21,250 head were reported; whilst from Scotland the arrivals were on a fair average scale.

Although the crop of grass was deficient in most parts of the United Kingdom, and the quantity of hay secured was scarcely an average, most breeds of sheep made their appearance in greatly improved condition. The Downs, half-breds, Leicesters, Lincolns, Kents, and Hampshire Downs especially were in prime order; nevertheless, the mutton trade was in a healthy state, and prices were remarkably steady. Up to quite the close of the season lambs came forward in rather large numbers, and the sale for them was rather active at high rates. Calves and pigs were in but moderate request, and the supplies in the market were far from extensive. The annexed Table shows the total numbers of each kind of stock exhibited in the last six months the year 1853, as well as in those of the last four years:—

*Total Supplies of Stock Exhibited.*

Last half of year.	Beasts.	Cows.	Sheep and Lambs.	Calves.	Pigs.
1853 .. ..	149,008	3191	860,800	17,058	15,284
1860 .. ..	145,420	3015	762,740	15,766	15,470
1861 .. ..	149,750	3187	774,260	12,441	20,116
1862 .. ..	159,450	3148	759,671	12,579	18,220
1863 .. ..	168,232	3127	761,070	14,822	17,550

The excess in the total supply of beasts over that of the last six months in 1862—8782 head—arose from large arrivals from the Continent, which rather exceeded 61,000 head against 37,843 head in the preceding year. It follows, therefore, that the

additional supplies have been made up of foreign importations. The district bullock arrivals are detailed in the following statement:—

*District Bullock Arrivals.*

Last half of year.	Northern Districts.	Eastern Districts.	Other parts of England.	Scotland.	Ireland.
1853 .. ..	54,650	8650	14,500	4728	7,412
1860 .. ..	66,140	9500	20,500	1151	7,852
1861 .. ..	71,450	2500	9,700	4586	14,340
1862 .. ..	74,579	5050	19,620	3307	14,820
1863 .. ..	66,510	3850	21,250	3213	11,280

The supplies of foreign stock showed greatly improved quality. Many of the beasts sold at from 25*l.* to 29*l.*; whilst some of the sheep realized as much as 62*s.* each. At these rates they were taken somewhat freely by the West-end butchers. These remarks have special reference to the arrivals from Holland. Those from Germany exhibited slightly improved points; but their general condition was inferior. The calves and pigs were, if anything, of better quality than in the two previous years:—

*Imports of Foreign Stock into London during the last Six Months of 1863.*

From	Beasts.	Sheep.	Lambs.	Calves.	Pigs.
Amsterdam .. ..	165	10,715	..	..	..
Antwerp .. ..	46	120	..	764	..
Boulogne .. ..	..	..	..	28	30
Bremen .. ..	3,619	842	24	..	..
Calais .. ..	..	..	..	287	221
Corunna .. ..	388	..	..	..	..
Dordt .. ..	4,312	18,099	5,804	342	..
Gluckstadt .. ..	13	..	..	..	..
Hamburg .. ..	1,628	32,705	..	24	7,421
Harlingen .. ..	10,144	29,960	1,212	2,344	9,749
Medemblik .. ..	1,158	30,430	..	55	..
New Dieppe .. ..	131	3,446	..	162	..
Oporto .. ..	536	..	..	..	..
Ostend .. ..	206	538	16	409	44
Rotterdam .. ..	13,162	68,600	4,454	13,078	1,471
Touning .. ..	24,874	27,969	6,275	4	..
Vigo .. ..	1,053	..	..	..	..
Total .. ..	61,435	223,424	17,785	17,497	18,936

The foregoing return shows a large increase in the exports from Harlingen, Rotterdam, and Toning. From Bremen, Dordt, &c., the shipments were likewise on an improved scale. The number of sheep shipped from Hamburg was about 7000



in excess of 1862, in the last six months of which 37,843 beasts, 178,554 sheep, 12,279 lambs, 11,436 calves, and 12,232 pigs, were received from all sources into London. The statistics issued by the Board of Trade thus return the importations into the United Kingdom during the last six months of the following years:—

*Imports into the United Kingdom.*

Year.	Beasts.	Sheep and Lambs.	Calves.	Pigs.
1862 .. ..	57,356	250,140	19,610	17,279
1861 .. ..	59,049	266,249	19,715	25,919
1860 .. ..	59,817	243,804	19,594	21,510
1859 .. ..	48,841	192,750	14,764	9,965
1858 .. ..	54,348	163,840	19,494	11,315
1857 .. ..	51,155	147,096	18,273	10,172
1856 .. ..	51,418	131,472	16,179	9,707
1855 .. ..	55,222	142,712	14,905	11,762
1854 .. ..	65,881	145,406	16,355	10,440

The quotations, taking the average of the last six months, were 2*d.* per 8 lbs. higher for beef, and 4*d.* per 8 lbs. higher for mutton, than in 1862. They compare with previous years as under:—

*Average Prices of Beef and Mutton.*

Per 8 lbs. to sink the Offal.

BEEF.

	1849.	1850.	1851.	1852.	1853.
	s. d.	s. d.	s. d.	s. d.	s. d.
Inferior .. ..	3 0	2 8	2 8	2 4	2 8
Middling .. ..	3 8	3 4	3 6	3 4	3 8
Prime .. ..	4 2	4 0	3 10	3 10	4 10

	1854.	1855.	1856.	1857.	1858.
	s. d.	s. d.	s. d.	s. d.	s. d.
Inferior .. ..	3 2	3 4	2 10	2 10	2 10
Middling .. ..	4 0	4 2	4 0	3 10	4 0
Prime .. ..	5 0	5 2	5 2	4 10	5 2

	1859.	1860.	1861.	1862.	1863.
	s. d.	s. d.	s. d.	s. d.	s. d.
Inferior .. ..	2 10	2 8	3 0	3 2	3 4
Middling .. ..	4 0	4 0	4 0	4 0	4 2
Prime .. ..	5 2	5 4	5 0	4 10	5 0

## MUTTON.

	1849.	1850.	1851.	1852.	1853.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Inferior .. ..	3 4	2 10	2 8	2 10	2 10
Middling .. ..	3 10	3 4	3 2	3 10	4 4
Prime .. ..	4 4	4 2	4 0	4 8	5 2
	1854.	1855.	1856.	1857.	1858.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Inferior .. ..	3 2	3 6	3 6	3 0	2 10
Middling .. ..	4 0	4 2	4 4	4 2	4 0
Prime .. ..	5 0	5 0	5 4	5 4	5 2
	1859.	1860.	1861.	1862.	1863.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Inferior .. ..	3 0	3 2	3 2	3 8	4 0
Middling .. ..	4 2	4 6	4 6	4 8	5 0
Prime .. ..	5 2	5 10	5 8	5 6	5 10

Owing to the fine condition in which both beasts and sheep have come to hand, the supply of rough fat has considerably increased, and the price has fallen to 2*s.* 1*d.* per 8 lbs. against 2*s.* 3½*d.* in 1862. If we may judge from the quality of the stock in the hands of the Norfolk graziers, and the present state of the tallow market, there is very little prospect of fat becoming dearer.

Advices from Holland and Denmark state that in all probability increased shipments of stock will be made to this country in 1864. But they probably will not more than balance our increasing consumption. The steady increase in our home production of really consumable meat will, however, prevent any decided advance in prices.

Newgate and Leadenhall markets have been heavily supplied with each kind of meat—the arrivals from Scotland and the north of England having been very large—yet the trade has been firm.

The state of the wool trade during the last six months may be briefly referred to. The unusually high prices demanded for cotton, arising from its scarcity, and the active inquiry for woollen goods for export, produced a firm market for all descriptions of wool, and a rise in the quotations of 2*d.* per lb. on the average sales. The quantity of English wool taken by continental houses exhibited a deficiency when compared with some former periods; but their purchases of colonial were on an extensive scale. The market was, therefore, relieved of any excess in the supplies arriving from our colonies, and the bulk of our

native clip was worked up at home. In the year, two public sales of English wool were held in the metropolis, and the whole of the quantities offered, about 2500 packs, was readily disposed of. The experiment will, we understand, be repeated; but as yet it has not met with much success, the prices realised at the auctions not having exceeded those offered to the growers in various localities. During the whole of 1863 the importations of wool into England were as follows, compared with 1862:—

	1862.	1863.
	Bales.	Bales.
Colonial .. .. .	345,605	375,010
Foreign .. .. .	222,063	220,316
Total .. .. .	567,668	595,326

There was, it will be perceived, a slight falling off in the supply of foreign wool at hand last year, but an increase in colonial of 29,405 bales. The export trade took off about 50,000,000 lbs. of colonial, 14,000,000 lbs. foreign, and 8,500,000 lbs. English, or in all 72,500,000 lbs. In the previous year the aggregate shipments were about 60,000,000 lbs. The present market value of each kind of English wool is as follows:—

						per lb.			
						s.	d.	s.	d.
Shropshire Down tegs	..	..	..	..	..	1	5	to	2 1
" ewes	..	..	..	..	..	1	11	to	1 11½
" lambs	..	..	..	..	..	1	4	to	1 4½
South Down tegs	..	..	..	..	..	1	9½	to	1 10½
Leicestershire ewes and wethers	..	..	..	..	..	1	5	to	1 11½
" lambs	..	..	..	..	..	1	2½	to	1 6½
Somersetshire ewes and wethers	..	..	..	..	..	1	11	to	1 11½
Hertfordshire ewes and wethers	..	..	..	..	..	1	8¼	to	1 10½
Lincolnshire hoggets	..	..	..	..	..	2	1	to	2 2
" ewes and wethers	..	..	..	..	..	1	6¾	to	1 11¼
Wiltshire, Hampshire, &c., tegs	..	..	..	..	..	1	10½	to	1 11
" ewes and wethers	..	..	..	..	..	1	9½	to	1 9¾
" lambs	..	..	..	..	..	1	5¼	to	1 8¾
Kent tegs	..	..	..	..	..	2	1½	to	2 2
" ewes and wethers	..	..	..	..	..	2	0	to	2 0¼
" lambs	..	..	..	..	..	1	6	to	1 6¼
Norfolk, Suffolk and Essex tegs	..	..	..	..	..	1	9¼	to	2 0¼
" ewes and wethers	..	..	..	..	..	1	8½	to	1 11¼

The continuance of a high range in the value of money in the discount market is calculated to have some influence upon the demand for wool; but so long as cotton is selling at high currencies, so long shall we have a steady sale for home and colonial qualities.

## MISCELLANEOUS COMMUNICATIONS AND NOTICES.

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### 1.—*Swedes, Mangold, and the Steam-Plough.* By CHARLES LAWRENCE.

IN the 22nd Volume of our Journal I gave some reasons for considering it desirable to invite members of the Society to communicate, in short articles, the results of any experiments they might have made, or of any special modes of treatment in the cultivation of various crops, and in the management and feeding of animals, under some such head as "Miscellaneous Communications." Reports of this description are often productive of utility beyond their intrinsic merits. They set men thinking, and thus become the origin of more important practices. I send another specimen of the contributions to which I referred, in the hope of encouraging others to do the like.

Some three or four years ago I recommended the mixture of mangold and Swedes in the same field, in another publication; \* and I gave my reasons for the adoption of that course. Having occasionally since observed the admixture, adopted in various ways without attention to the special grounds on which it was recommended, I will here repeat the principles on which I adopted and have continued it with satisfactory results.

The deterioration of the Swede crop of late years has been matter of common remark; and has been attributed, reasonably enough, to the too frequent repetition of the crop on the same ground. It had been my practice, as is usual, to feed off the Swedes on the land with sheep; which produced a heavy growth of barley, but always more or less laid by heavy rains in June and July, to the great damage of the corn, and the clovers sown with it. This was a source of double mischief, requiring remedy. As the mangolds are necessarily hauled off for storing near the feeding-stalls, it occurred to me that both the difficulties which I have referred to might be obviated by growing a given number of rows of Swedes, and then the same number of rows of mangolds, alternately over the field; and by merely reversing the order of these roots when the field should come again in course for the root-crop, the result would be

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\* My 'Handy-Book for Young Farmers.' Longman and Co.



that the Swedes and mangold would be repeated *on the same ground* once only in eight years; and half the crop, the Swedes only, would be fed off, to the benefit of the barley. The sheep being folded *across* the lines of the root-crop, the whole field would be equally manured to the advantage of the barley. As the land requires the same preparation for the Swedes as for the mangold, there is no practical difficulty in this arrangement, though the periods of sowing vary. We drill the rows for the mangolds the latter end of April, and those set out for Swedes the beginning of June.

As a mere matter of detail, 12 rows of each are found a convenient number. If 28 inches apart, each crop would occupy a space of about 28 feet in width. If the 12 rows are pulled, and placed ready for topping in four lines, reckoning 3 feet for each line, there will be 8 feet clear on either side for the carts when removing the mangolds.

The cultivation of roots, in these days, naturally suggests to the mind the preparation for them by the agency of steam. I do not possess the requisite engine and implements, but as my farm adjoins that of the Agricultural College, I have hired their engine and Mr. Fowler's plough the last three autumns. The two first seasons we used the regular plough, turning over a furrow averaging about nine or ten inches in depth, for the ensuing root-crops. The result was the two worst crops of Swedes and mangolds I have ever experienced. I record this in order to prevent any farmer who may have screwed up his courage to hire a steam-apparatus from being hastily discouraged by a similar result from a repetition of the experiment. The comparative inferiority of the first crop under such circumstances, to a greater or less extent, is a necessary result, unless the plough be followed by the cultivator drawn by the same agency, at the same depth, once or more in the following Spring. Otherwise, the seed will be deposited in soil which has not been for ages exposed to those influences which are essential to the formation of a proper seed-bed. Any attempt to accomplish the due admixture of this subsoil with the productive soil at a depth of 10 inches by the ordinary cultivator worked by horses would be fruitless. It is only by the product of the entire course of cropping, whatever that may be, that the result of the first operation by steam-power can be justly estimated.

From the first moment I saw the plough at work, I had the impression it was not the right implement. I very much preferred the state in which the land was left by Mr. Smith's cultivator, which, according to my judgment, leaves the land in a much more favourable position for atmospheric culture during the winter, and consequently for spring tillage. Last autumn

I used what are called the *digging breasts* on Fowler's plough with much satisfaction. I regard these digging breasts as a step in the right direction towards the more effectual smashing up adopted by Mr. Smith. It so chanced that I visited his farm early in the spring, when he was commencing his operations on land turned up by his implement in the previous autumn, and I had an opportunity of comparing the state of it with that of mine, which had been turned down by the steam-plough at the same season. I consider my land naturally superior to that which surrounds Mr. Smith's farm, and much more easy to cultivate; but while my deep furrow remained unbroken, there having been very little frost during the winter, involving the necessity of expensive and repeated cultivation, with a most unsatisfactory seed-bed at last, I found Mr. Smith actually drilling his beans in an admirably prepared soil, the drill preceded by cultivating tines on the same frame as his drill, on the land smashed up by his machine the previous autumn, without any intervening operation. It is true that Mr. Smith's land had undergone a similar autumn preparation in a previous course; but it was clear to me that the actual working condition of his land resulted chiefly from the greater extent of surface favourably presented to atmospheric influences during the winter.

*Cirencester, January 23rd, 1864.*

## 2.—*Method of converting old Barns into Cattle-Boxes.*

*"To P. H. FRERE, Esq.*

"DEAR SIR,—As you asked me to send you an account of my method of converting old-fashioned barns into cattle-boxes, I beg to hand you the following short paper, with an illustration referring to a barn fitted up on my own property at Bursledon, near Southampton.

"Having during the last seven years thrashed the whole of my corn by steam-power, and believing that corn is generally better placed in ricks than in barns for that purpose, and my barns having been empty during ten months of the year, I have adopted the practice of feeding cattle of different ages in them, as I invariably cut my clovers for soiling stock in the green state, instead of incurring the expense and risk of making hay. I have found there is no accommodation for feeding cattle under cover equal to that afforded by an old-fashioned thatched barn, which is warm in the winter and cool and healthy for the animals in the summer; and although I have designed and built upon properties under my agency cattle-boxes upon the newest

and most approved principle, and have also seen some of the best cattle-feeding establishments in the kingdom, yet I assert that practically, for both summer and winter feeding of cattle of different ages under cover, I have seen nothing to equal the advantages to be derived from an old barn properly fitted up, the roof being usually so much higher than that of buildings specially designed for box-feeding. The accompanying illustration exhibits what was originally a barn, with straw-house attached; the barn-part is fitted up so that it may be filled with corn at harvest, and it has been thus used during the present season—the corn was threshed out at the end of six weeks, and it has since been occupied by both store and fatting cattle. It will be noticed in the sketch that the rails dividing the boxes are made to take apart.

“My estimate of constructing the boxes is as follows:—

	£.	s.	d.
Required 6 rails of fir poles, 11 feet long and about 3½ inches diameter, with ends chopped square to fit into the supports, say 6d. each .. .. .	0	3	0
Two upright fir posts, 8 inches diameter, let into the ground 2 feet, and screwed at top to tie-beams of barn, at 3s. each .. .. .	0	6	0
12 iron brackets made of ½ by inch wrought iron, at 8d. each .. .. .	0	8	0
2 slabs, 10½ feet long, at side of feeding path, 2s. each ..	0	4	0
10 yards of cube digging .. .. .	0	5	0
Carpenter's wages for erection, &c. .. .. .	0	3	0
Total cost of each box .. .. .	£1	9	0

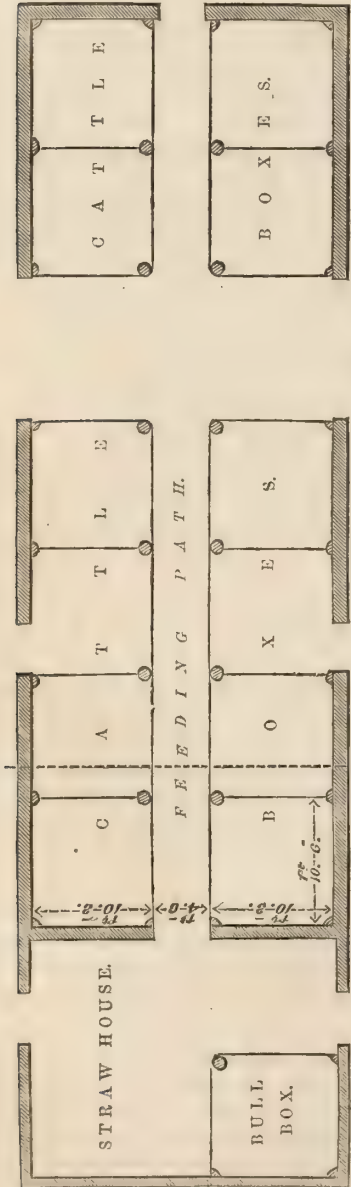
“This must be considered a very moderate amount, and it may be further diminished upon all soils, excepting gravel or stone, by breaking up the bottom of the boxes; which, after being saturated with the liquid-manure, may be removed with the dung when the boxes are cleaned out; this, being repeated a few times, will excavate the boxes to the required depth of 2 feet.

“In most cases it will require care not to disturb the ground-pinning brickwork; I therefore leave about 8 inches width of soil next to the brickwork.

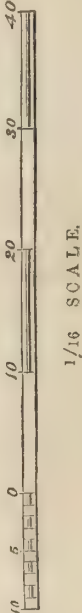
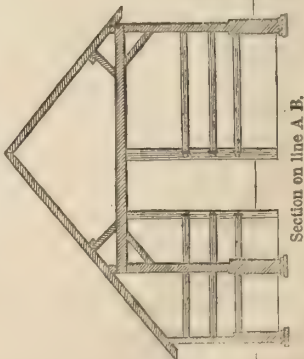
“It will be found that the barn-floor, being 13 feet by 24 feet, affords ample room for the cutting of turnips, chaff, &c., and also store-room for a considerable quantity of roots and hay, and the feeding-path leading from the floor gives access to all the boxes alike.

“The accommodation requisite for cattle whilst feeding under cover is so much on the increase, that the question how boxes can most readily and economically be furnished is interesting to both landlord and tenant; the former, although desirous of encouraging the latter to keep a larger number of cattle, may

hesitate before putting up new buildings for the purpose, but may fairly point out to the tenant the purposes to which the ordinary barns of the farm may be converted.



PLAN OF OLD BARN FITTED UP WITH CATTLE BOXES.





“At the same time the cost is so small, as I have here shown, that few tenants would object to fitting up barns in the manner described, if the landlord granted permission and at the same time allowed some of the materials.

“JOSEPH BLUNDELL, Land Agent, &c.

“*Bursledon, Nov. 26th, 1863.*”

### 3.—*On Regulating the Sex of the Offspring of Animals.\**

IF there be any device for regulating the sex of the offspring of our flocks and herds, every breeder is interested in knowing it; even if a hint can be given which only improves his chance, without costing much trouble, it still is a boon.

It would seem from the following testimonial that Professor Thury of Geneva had got some insight into one of the factors which enter into this complicated and mysterious problem:—

“I, G. Cornaz, manager of the property of my deceased father, M. A. Cornaz, late President of the Agricultural Society of Roman Switzerland at Montet, Canton de Vaud, hereby certify that I received from M. Thury, Feb. 18, 1861, a paper containing confidential instructions for the purpose of making a practical experiment to ascertain the law which regulates the sex of the offspring of animals.

“I have applied these directions to my herd of cows, and have obtained at once, without any tentative trial, the desired results.

“In the first instance, in 22 successive cases, I endeavoured to obtain heifer-calves. My cows were Swiss, and my bull a pure Durham. Heifer calves were, therefore, in request—bull calves only fit for the butcher; *in every instance I obtained the desired result.*

“Later, when I had bought a pure-bred Durham cow, I was anxious to breed a bull to take the place of the one which I had bought at a large price. Again I acted according to Professor Thury’s directions, which are ready of application, and again I was successful.

“Besides my Durham bull, I designedly bred 6 half-bred oxen for the plough from cows selected for their colour and size. My herd comprised 40 cows of all ages.

“On the whole I have tried the new directions twenty-nine times, and in each case obtained the desired result, male or female; I have had no instance of failure. I personally watched

\* For the materials on which this and the following papers are based the editor is indebted to the ‘*Journal d’Agriculture Pratique.*’

each trial. I can consequently declare that I consider Professor Thury's system to be real and certain, and I hope that all breeders will speedily profit by it.

“Drawn up at Montet, February 10, 1863.

“(Signed), G. CORNAZ.”

We may learn from a pamphlet of Professor Thury, ‘On the Law which regulates the Sex of Plants and Animals,’ what is his scientific theory, and what are the practical directions which he deduces from it.

The following statement is a brief summary of his views. Starting with the vegetable kingdom, Professor Thury adopts the theory of Knight, who, in concert with Wolff, De Candolle, and Robert Brown, considered stamens and pistils to be fundamentally identical (both being modifications of the leaf), and further regarded the production of the male organ in plants as due to greater maturity or more perfect development.

Considering how general the laws of Nature are, the Professor infers that the propagation of animals follows an analogous course. He states that it has already been admitted that for certain oviparous animals the last hatchings produce males; that Huber recognized as fact that early fecundation produces female bees, and *vice versâ*; and so from one step to another he arrives at the conclusion that an egg yet unimpregnated, is female during the first part of its passage down to the matrix, and male in the last part. The sex, then, of the creature will depend on the degree to which the egg is matured at the moment of fecundation. He therefore considers it to be a general law that fecundation which follows shortly after “heat” or menstruation breeds female offspring, and *vice versâ*.

The following are his directions and cautions:—

1. The peculiarities of different cows should be observed and taken into account. The number of hours during which they take the bull varies from 24 to 48. To obtain a heifer, the first part of this period is selected; for a bull-calf, the latter part.

Exceptional animals, such as are fat or tied-up, afford no fair criterion; but healthy, well-conditioned specimens, living in the open air, should be selected for experiment.

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These views must only be taken for what they are worth; so far as the result depends on the mother, and she is a fair representative of her sex, the hint may be serviceable; but that the sex of the offspring is quite independent of the sire, as is here assumed, is a doctrine which will not pass unchallenged.

I will conclude this notice by an extract from a letter addressed to me on this subject by Professor Wilson:—

“It is very desirable that these principles should be properly tested on a sufficiently large scale, and by reliable persons who would themselves take care that the advice given should be correctly followed. A few years’ experience would then enable us to determine whether M. Thury’s deductions are valid as a law.”

#### 4.—PROFESSOR VILLE’S *Experiments on the Growth of Wheat.*

IT may be well for the same Journal which records the important results of Mr. Lawes’ continuous experiment on the growth of wheat, to make some mention of trials now in progress in France, undertaken with a similar aim and resting on a somewhat similar basis.

M. Ville has been for some time known as a man of science who had turned his attention to vegetable physiology in connection with chemistry, and his experiments for testing the conditions of the growth of plants in artificial soils and atmospheres have excited the more notice because the results he obtained were at variance with those of Boussingault and others.

M. Ville affirms with increasing confidence the doctrine that plants can, to some extent, feed directly upon the nitrogen in the air; a belief which Boussingault seems to have been constrained by his own most accurate experiments to renounce, even in regard to that tribe of plants for which he had formed favourable anticipations.

That zealous patron of Agriculture, the Emperor of the French, has installed M. Ville in a Professorship of Natural Philosophy at Paris; has provided for him a splendid laboratory on a scale which rivals Rothamsted; and, to complete the parallel, has put at the disposal of the Professor trial-fields at the Imperial Farm of Vincennes, where the doctrines of the class-room are set forth in field doctrines, and illustrated by growing practical results. The three varieties of plants have been selected for a continuous experiment in the same soil with the same chemical fertilizers: wheat, to represent the cereals; peas, for the leguminosæ; and beet-root.

These trials have already been maintained for three years; and the wheat crop, now to be recorded, is the third produced in three successive seasons from one dressing applied in December, 1860.

It has been objected to Mr. Lawes, by Baron Liebig, that his dicta have been verified only on one class of soils; and the objection, so far as it is correct, is important: it is therefore a happy circumstance that the land assigned to M. Ville is

a very porous sandy loam resting on gravel which contrasts favourably with the clayey loam that overlies the chalk at Rothamsted. In the words of M. Barral, "Le sol en est argilo siliceux, de consistance assez légère mélangé de gravier, avec un sous-sol formé d'un gravier assez compacte." This is evidently a poor soil, and therefore well suited for testing the relative action of different manures. In one respect, however, it seems doubtful whether the French trial-field, situate on the skirt of the Wood of Vincennes, be a good representative of general husbandry; for if it be new land—a recent clearing on which humus has more or less accumulated, the advocates of the mineral theory will hardly have pitched upon a fair field of battle.

Preparatory to the experiments, the soil was stirred to the depth of from 8 to 10 inches by the hand-grubber (*la bêche*) a short-handled picker, with either a broad point or with bent prongs,—a most effective implement in the hand of the peasant proprietor for autumn or winter cultivation.

M. Ville's design is to test manures of four different classes, nitrogenous, phosphatic, calcareous, and alkaline, in varied combinations, and in contrast with the unmanured soil.

To this end, directly after the grubbing, the trial wheat-plots (1 are = 4 poles nearly) received in December, 1860, the following dressings as here computed for the English acre:—

	lbs.
Muriate of ammonia .. .. .	579
Phosphate of lime .. .. .	352
Double silicate of potash and lime .. ..	528

The muriate of ammonia was derived from the sal ammoniac of commerce, it contained 24·92 per cent. of nitrogen; this supply was reckoned to correspond with that furnished in 10 tons 18 cwts. of farmyard manure. The phosphate of lime was obtained from the precipitation of chloride of calcium by phosphate of soda; it was consequently a very pure and *fine* substance. The double silicate of potash and lime was provided by M. Kuhlmann, of Lille, and it contained one-third part of potash, one-third of lime, and one-third of silica, or silicious acid. The cost was estimated at from 8*l.* to 9*l.* 10*s.* per acre.

This single dressing has afforded three successive crops (two of spring wheat, the last of winter wheat), amounting each year, as the 'Moniteur' asserts, to 35 hectolitres per hectare (38½ bushels per acre).

The Abbé Moigno in his Journal, 'Les Mondes,' speaks of these crops as "the most astonishing verifications of the experiments of the laboratory," demonstrating the part which each constituent of a *complete* manure plays in the development of



the plant, and the consequent shortcomings of partial dressings; the absolute necessity of nitrogen for wheat, of silica for peas, and of potash for both one and the other, being thus forced upon the view. But we have a more severe and perhaps a more experienced witness and critic than these in M. Barral, the Editor of the '*Journal d'Agriculture Pratique*.'

That accomplished Editor, it appears, has occupied a position in some degree antagonistic to M. Ville, being in part influenced "by his reverence for an illustrious savant (Boussingault), whose opinions M. Ville had attacked." A sense of public duty almost *constrained* M. Barral to visit Vincennes, where he was courteously received and urged to inspect in person the harvesting of certain of the trial plots. The general survey, and the table of results which follow, rest upon his excellent authority. "A glance at the different plots," he writes, "was sufficient to show, that where a dressing of manures, complete according to M. Ville's view, had been applied, the crop would exceed 30 hectolitres (33 bushels per acre), and that on the other plots the yield would fall much below 20 (22 bushels).

He further states:—"On the 23rd of July a square which had received the complete manure was cut and thrashed in my presence, and on the 30th of July one-half of another plot which had only received phosphate of lime. On that same day the crop on an unmanured plot, which had been previously cut, was also thrashed." (These plots were part of the third successive wheat-crop from land cultivated and manured in 1860.)

The seed had been sown by hand at the rate of rather more than  $1\frac{1}{2}$  bushels per acre in lines about  $5\frac{1}{2}$  inches apart. Each experimental plot (are) contained 8 beds a metre (39 inches) wide, having 7 drills with a path nearly 13 inches wide between the beds, a cord being fixed round each bed to support the ears.

The plots tested varied in extent from 4 poles (the unmanured) to about 105 square yards (for the complete manure), and 60 square yards (for the phosphate). M. Barral gives the details in full, but it will best suit our purpose to give only the results as adjusted to our own measures and weights:—

Crop per Acre.	Ville's complete Manure.			Phosphate of Lime alone, 352 lbs.			No Manure.		
	lbs.	cwts.	lbs.	lbs.	cwts.	lbs.	lbs.	cwts.	lbs.
Straw .. .. .	5670	=50	70	1584	=16	28	1821	=16	28
Chaff and short stuff ..	645			264			290		
Corn .. .. .	3324	=19	80	862	= 7	78	721	= 6	49
Yield in bushels .. ..	57.5			14.4			12.2		
Weight per hectolitre ..	Kil. 79.5			Kil. 75.			Kil. 74.5		

These results, adds M. Barral, speak for themselves. To obtain such an excess of produce for three successive years, if it has been done for three years, at a cost of from 8*l.* to 9*l.* per acre, is magnificent.

Due allowance must, however, be made for the effect of the trenching, and of the subdivision into squares (and possibly for an unusual supply of humus), but otherwise it would seem that if a mixture of chemical manure, such as may be represented by nitrate of soda and phosphate of lime, with the addition of some potash, gave good results on such a soil as this, we may hope to find them generally effectual. The four principal elements are thus provided: other constituents are not less necessary, but in such small quantities that most soils have already a sufficient supply.

The real importance of these minor constituents is well illustrated by some experiments on the minute must-plant (*Ascophora nigrans*), conducted by Professor Raulin of Brest, as quoted by M. Barral. The Professor writes, "By a judicious choice of mineral substances, this plant may be made to develope itself in an artificial medium as rapidly as in its most appropriate natural fluids. Vegetation continues till one constituent runs short. The mineral substances requisite may thus be stated in their order of importance—Phosphorus, Potash, Magnesia, Sulphur, Manganese. These were supplied in the form of phosphate of ammonia, carbonates of potash and magnesia, sulphate of potash, and carbonate of manganese. If a fluid which contains all these substances will produce, say 20 grains of this plant, one that only differs from it by the absence of manganese will then only produce 5 grains in the same time; if sulphur be withheld the product will only reach 2 grains; if magnesia or sulphur, only 1 grain; if phosphorus, only half a grain. The required amount of these substances is very small, amounting to not more than 2 per cent. of the plant's bulk of even phosphorus, which is most in requisition; there are probably yet other substances which likewise enter into its constitution, but in still smaller degree." This illustration of the wide difference which subsists between manures which are practically complete, and those which fulfil the rigorous scientific conditions of completeness, may fitly close this notice of signal, if not exceptional, success obtained by the use of artificial manures on a light porous soil.

##### 5.—*The Artificial Fecundation of Cereal and other Crops.*

MUCH interest and discussion has been excited of late in France by M. D. Hooibrenk's proposed methods of increasing the produce both of corn and of fruit-trees, which have attracted the attention of the Emperor, have been investigated by a special

commission of the highest character, have been the subject of several official documents published in the 'Moniteur,' and have been honoured with a special notice in the 'Ministerial Report' on the present status of the Empire.

Our agricultural press has, from time to time, given currency to much of this intelligence, yet it may be well to lay it before our readers in a combined form, much condensed, freely rendered into English rather than closely translated, the quantities being given in English weights and measures, that the report may be intelligible to the ordinary farmer, which *otherwise is not the case*.

Since the experiments which affect corn-crops concern us more than those made on vines and fruit-trees, our attention will be restricted to the former class.

The practical aspect of the question will best be gathered from the careful directions issued by Marshal Vaillant, as head of the Commission, to ensure completeness for the fresh trials which are to be made in 1864 at the Imperial farms, at the leading agricultural colleges, and on the estates of some distinguished agriculturists.

If the results obtained by one series of tests may be thoroughly relied on as representing the average effect produced on large fields of similar quality, treated alike, M. Hooibrenk will have converted one of the curiosities of garden practice into a most important feature in the management of the farm. It is, however, unfortunate that a second test, emanating from the same high authorities, more accurately executed, but on a still smaller scale, gave results much at variance with the first.

In 1863, the chief experiments have been conducted on the well-known estate of Sillery, in Champagne, the property of M. Jacquesson, a gentleman of the highest character and position, who invited M. Hooibrenk to take up his residence in France. The experiments were there tried on a large scale for wheat, rye, oats, and barley, growing on 200 acres, in fields of  $37\frac{1}{2}$  acres and upwards. In these fields two-and-a-half acres were left in their ordinary state, and the rest operated upon. The plots hitherto *tested* have, however, contained only 4 rods and a square mètre (39 inches) respectively, so that we may look for the result of the thrashing of the general crops with some interest.

Let Mr. Hooibrenk first state his theory respecting artificial fecundation in his own way. He teaches us that: It is not so simple a matter as it appears at first sight, to decide whether a crop is in flower or not; as your decision depends on the direction in which you walk, the stamens which turn to the east or the south being commonly developed before those on the west and north sides.

It is a general rule in the vegetable kingdom that the pistil or

female organ is ready to be impregnated before the pollen on the stamens is matured. Here, as in the animal kingdom, the female organ is the more precocious; it is also the more susceptible of injury from rain, fog, frost, or insects, which may disturb the little honey-drop placed on its tip to receive the pollen and transmit it to the ovary—the seat of the embryo. If this drop have disappeared, the advent of the pollen can do no good.

The pollen, on the other hand, has such a hardy constitution that it may be kept for seven or eight years without losing its efficacy.

To remedy, as far as possible, this risk of injury, the fringe used in the artificial process is moistened with honey, which is the same substance as this drop—for the bees *collect*, but do not convert their store.

The law of cross-breeding applies as well to cereals as to all other produce; and the grain which is impregnated with pollen from a neighbouring ear is always finer than that which has received the pollen from the same ear.

The following is a summary of the advantages to be derived from the artificial process:—

1. The happiest moment is chosen for the fecundation, instead of waiting for a breeze, which may not approach till the pistil has been impaired.

2. Whereas, in a state of nature, a good many ovaries are fecundated on the first day, on the second day not so many, on the third still fewer, and so on for a week or even ten days, by the artificial process, all that are ready are impregnated at once, and nearly all the rest (those to the north and west especially), within three or four days; the grains therefore ripen, and are fit for harvesting together.

3. Whereas, in the ordinary ear the grains are largest at the bottom, and diminish as they mount upwards, until the topmost spikelets are empty and unprofitable, “fecundation” makes all the grains equal in size from bottom to top, and on all four faces of the ear—all the spikelets are full, and the ear is as square as possible.

4. The artificial process adds force and vigour to the whole plant.

The Commission issued by M. Behec, Minister of Agriculture, included M. Payen, the famous chemist and philosopher; M. Dailly, a practical agriculturist, member of the Central Society of Agriculture; M. Lefour, the late President of the International Exhibition at Lille; with M. Simon, Chief Secretary to the Minister.

Three Commissioners visited Sillery on the 24th of July, and in their presence trial plots of 4 rods each of wheat and rye



were cut, thrashed, weighed, and measured: the barley and oats were not then ripe, but a few days afterwards they underwent the same test in the presence of the Communal authorities.

The results which then obtained the sanction of the Commission (*ont été officiellement constatés*) were highly satisfactory to the experimenter, who felt warranted to state that his process had, on an average, added 50 per cent. to the corn-crop, and that, in a fine season, when artificial aid would be less telling than usual.

On the 10th of August the Commissioners read their Report to the Central Society of Agriculture; up to the end of 1863 this Report had not yet been published. After this Report, M. Dailly (the practical agriculturist of the Triumvirate) read a memorandum relating to a second testing, which was published in the '*Journal d'Agriculture Pratique*,' from which the following passages and calculations are extracted:—

"The produce per are (4 poles), of which you have just received the report, as tested at Sillery, on the 24th of July last, by M. Payen, M. A. Simon, and myself (M. Lefour being prevented by illness from accompanying us), corresponds with the following crops per hectare.

	Per Hectare.		Per English Acre.	
	Hectolitres.	Kilogrammes.	Bushels.	lbs.
Wheat fecundated* .. ..	41·5	3100	46	2728
Wheat not fecundated .. ..	30·5	2100	34	1848
Rye fecundated .. ..	34·5	2550	38	2244
Rye not fecundated .. ..	22·6	1600	25	1408

"If the number 100 represents the fecundated wheat and rye crops, the natural crop of wheat will be represented in bulk as 73·49, and in weight as 67·74; and the rye-crop in bulk as 65·50, and in weight as 62·64.

"We thought it would be well to try whether the produce obtained on a square mètre (39 inches) corresponded with those already determined on the plots of one 'are' each. The four plots were cut before our eyes, and the stalks gathered on each were tied up and ticketed."

M. Dailly then states very minutely the extreme care with which one-half of each of the four bundles was examined at Paris; the amount of straw, "short stuff," chaff, and grain, the number of stalks of corn and stems of weeds, and the number of grains required to fill a small measure—being carefully recorded. This second trial, reduced to the same standard, gave results as follows:—

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\* The wheat field,  $37\frac{1}{2}$  acres, had received 20 tons per acre of farm-yard manure, according to the custom in Champagne. The rye, also  $37\frac{1}{2}$  acres, followed a wheat-crop, no manure at all had been applied.

	Per Hectare.		Per Acre.	
	Hectolitres.	Kilogrammes.	Bushels.	lbs.
Wheat fecundated .. ..	35·00	2550	39	2240
Wheat not fecundated .. ..	32·00	2340	36	2059
Rye fecundated .. ..	28·40	2000	32	1760
Rye not fecundated .. ..	17·00	1200	19	960

Or, if as before, the fecundated crops be represented by 100, then the natural wheat-crop is now represented in measure as 91·42, in weight as 91·76 ; and the rye-crop in measure as 59·89, in weight as 60.

The half-bundle of the wheat left to nature contained 215 ripe and 7 unripe stalks, in all 222, with two stems of weeds ; its competitor had 225 ripe stalks and 13 weed stems. With the rye, the natural crop had 142 stalks of corn, many of which were blank, and 22 of weeds ; its rival had 242 stalks of ripe corn, and 16 of weeds. M. Dailly aptly remarks that the produce appeared to vary as the number of stems ; whereas the artificial process could exert no influence except on the number and weight of the grains in a given number of stems.

Of the natural wheat-crop only 166 grains were required to fill a centilitre, as against 175 grains of the rival parcel ; but of the natural rye-crop it took 259 grains as against 247.

It is elaborately calculated that the natural wheat-ear averaged 12 grains as against 13 ; and the natural rye 14 grains as against 15.

The reader may, by a little attention, see for himself how considerable the discrepancies are between the results of the two trials ; and if the smaller bundles were a fair sample, how small was the advantage gained in the quality of the ears. These reports, which emanate from nearly the same authority, are perplexing, if not discouraging. That which is favourable to M. Hooibrenk has the advantage of being based on the larger trial of the two. Meanwhile there are many indications that the question, though still an open one, is considered to possess much interest and importance. The following instructions, issued by Marshal Vaillant (which are here slightly abridged), bear sufficient testimony to this.

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*Instructions for the Conduct of Experiments designed to test M. HOOIBRENK'S Method of Artificial Fecundation, &c., of Cereals.*  
(Extracted from the 'Moniteur,' November 14th, 1863.)

M. Hooibrenk recommends the adoption of two distinct processes :—

- 1st. Rolling the corn three or four times after it is up ; and
- 2ndly. Artificial fecundation at the flowering season.

The first rolling should be done shortly after the corn is above

ground, when it is about 3 inches high; the second and third severally at a week's interval.

They should be performed at a slow pace, and on a day which, according to the usage of the district, would be considered favourable for the purpose. The same track should be followed each time and in the same direction, that the stems may be bent to the same side.

Autumn corn which has been rolled before winter should have one or two more rollings in spring, when vegetation revives. The roller should be grooved; it should be weighted according to the nature of the soil and the custom of the neighbourhood. (Experimenters will have a pattern roller delivered to them.)

If the autumn corn is "thrown out" by winter frost, the common roll of the country should be used to set it firm again.

Rape and maize are not to be rolled.

Artificial fecundation is put in operation when the plant begins to flower.

It is effected by a rope 25 to 30 yards long; to this rope are attached pieces of woollen twist (*torsades de laine*) 2 feet long, so as to touch each other and form a continuous fringe. A little piece of lead, the weight of a swan-shot, is fastened to one of the threads at intervals of 4 inches. The wool employed should be long and coarse.\*

The threads are smeared with a small quantity of honey by drawing the fringe through the moistened fingers.

To effect artificial fecundation the apparatus is drawn over the corn. The fringe ought to trail over the whole length of the ear, so that each spikelet, from the highest to the lowest, be brought into contact with its threads. The workmen should also, as they walk, make the rope shake the ears slightly. Three men are required for the work: two, placed at either extremity of the rope, draw it along; the third supports it in the middle, and gives it a slight lateral to-and-fro movement. This operation is repeated three times, at an interval of one or two days, and in calm weather. The first time it ought, as far as possible, to be performed from east to west, the second time from west to east, and for the last time the farmer may follow his discretion.

If there is dew or frost, the work should not begin before 10 A.M.; it should not be done in the rain.

The crop should, in all other respects, be treated according to the general practice of the neighbourhood in respect of tillage and manuring.

For rapeseed, buckwheat, and maize, the same rope and the

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\* The rope complete may be bought of M. Boucley, Rue Montholon, No. 34, Paris.

same procedure may be adopted, except that for maize the leaden weights should be heavier.

The apparatus should be washed after being used for each variety of plant.

That the influence of each of M. Hooibrenk's suggestions may be distinguishable, and clearness and precision given to the results sought, the Commission suggests that the experiments should be made in the following manner:—

The fields selected for experiment should, as far as possible, be similarly circumstanced as to soil, manure, tillage, and aspect, and apart from woods, roads, and avenues of trees.

Each field should be divided into four plots.

To the first, the ordinary management of the district should be applied.

On the second, rolling, but not fecundation, should be tried.

On the third, both the roll and the fringe should be used.

On the fourth, artificial fecundation should be tested without rolling.

The experimental plots may be restricted to a square measured off in the centre of an irregular field, or to four "lands" of like quality.

The crop should be harvested at the same time and in the same manner on all four plots; the head and tail corn, the straw and the short stuff, should each be separately ascertained.

At harvest time the number of stalks should be counted which are growing on one square mètre of ground of average character in each of the four plots.

All these stems should then be carefully pulled up, so as to preserve their roots, and they should be made into a bundle, labelled . . . . and forwarded to the Commissioners.

The experimenter is to fill up a schedule, of which a copy is furnished, and send a description of the field and its position, with an account of the fluctuations in the yield of the cereal under trial for a series of years on that spot; of the yield of other portions of the field or fields not under experiment; of the cost of the men and horses employed in rolling and fecundating the field; and he is invited to give his opinion of the value of the measures which M. Hooibrenk advocates.

One word of comment respecting the rolling referred to may be of use. In the vineyard and orchard much of M. Hooibrenk's art consists in giving to the side branches an inclination of 112 degrees. This idea has been imported into his cereal experiments, where it is, perhaps, less at home, seeing that rolling must cease before the stem is developed. This portion of the



experiment is not as novel or as interesting as the other; since, without connecting our practice with this new theory, good farmers have not overlooked the use of the roll, so far as leisure and a happy moment could be found.

It will, however, be useful to have the effects of *repeated* rollings separately investigated and carefully recorded.

#### 6.—The Leporide.

BOTH the farmer, who is more and more conversant with cross-breeding, and the naturalist, who cannot stand apart from the existing controversies on "species," are interested in the practical development given in France of late to a race of hybrids between the hare and the rabbit, which bears the name of "*Leporide*." This half-bred has been reared during the last seventeen years under the management of M. Roux, President or Vice President of the Agricultural Society of Charente, who appears to be an intelligent but unscientific and unobtrusive landed proprietor. Its fame has been spread abroad by M. P. Broca, a French naturalist, in a treatise on Hybridising, published in 1859,\* who twice visited and inspected M. Roux's establishment, and carefully weighed his explanations.

It appears that among the recognised hybrid animals are found (in addition to the mule) the offspring of the he-goat and the ewe; of the setter-dog and the bitch-wolf (of which breed four generations were reared by Buffon); of the camel and dromedary; Buffon's crosses between the ox, bison, and zebra; and those also obtained by John Hunter from dogs, jackals, and wolves.

Moreover instances have been already recognised of a hybrid birth from the hare and rabbit: between 1773 and 1780 the Abbé Gagliari, near Oneglia, bred from the *buck-rabbit* and the *doe-hare*, and Amorretti recorded the results in 1780. In 1831 the London Zoological Society received a communication relating to the chance birth of a hybrid from the buck-hare and doe-rabbit.

In this case a leveret had been reared with two young rabbits, buck and doe. The doe bore a litter of six young ones, of which three were common rabbits and the other three resembled the hare. One of the latter alone survived, and some years after was dissected by Professor R. Owen, whose examination settled the previously existing doubts as to the hare having been its sire. Its intestines, it is said, corresponded neither with those of the rabbit nor the hare; the great bowel differed but little from that of the rabbit, the smaller one was that of the hare. The skin

\* 'Recherches sur l'Hybridité Animale en général.

resembled that of the hare, but the hind limbs were like those of a rabbit, and the flesh was white. Owen recognised it as a hybrid.

That hybrids may be produced between these two animals seems not to be disputed; but that hybrids should be prolific and breed one with the other, or with either parent stock, has been a point of acrimonious contention, which is not the less bitter because it is prompted by a motive to which respect is due.

It has been a dogma of the Naturalists that hybrids of different species are sterile, and the hare and rabbit are classed as belonging to different species; moreover, points of religious belief have got mixed up with the Naturalist's creed respecting "species." So M. Roux and his reporters have been libellously assailed, and the truth of their assertions tested, and, as it seems, confirmed.

M. Roux's object in his cross-breeding was to unite with the prolific character of the rabbit some of the superior qualities of the hare. With this view the doe-rabbit was at first preferred (the doe-hare being a very shy breeder in confinement, besides being less prolific), and further modifications in the race were afterwards introduced. The first cross very nearly resembled the rabbit; the females among them were then put to the buck-hare, and their produce were "larger and stronger than either father or mother," yet in appearance they were only half way between the hare and rabbit. M. Roux next bred from this second generation ("*inter se*"), and the offspring resembled their parents, but the litters diminished in number down to from two to five; so a little more rabbit blood was thought desirable, and the does, three-quarter hare, were put to a half-bred buck. The result was quite satisfactory—the produce exhibited the handsome features and form of their mother, and they were prolific. When they were further bred from "*inter se*," the litters numbered from five to eight, and they were more hardy even than the rabbit, and easily reared: they grow fast, are precocious, and will begin to breed at four months. The gestation occupies thirty days; they suckle for three weeks: twenty-seven days after the last birth the doe may be put to the buck, and can very well rear six litters in a year.

It is stated that this breed supplies a large amount of meat for the food consumed; sold at the age of four months they make two francs in the market, when the warren-rabbit fetches only one franc. When older their skin becomes more valuable than that of the hare, and commonly sells for one franc. At a year old they generally weigh from 8 to 11 lbs.; picked specimens have attained to 12, 14, and even 17 lbs. With results such as these, M. Roux considered that he had reached his aim, and this new stamp of animal was to be retained and maintained.

To breed these animals the following course must be pursued:

a leveret should be caught between twenty and thirty days old, when he can live without being suckled; he should be kept with some young doe-rabbits of his own age, quite apart from any other animals: he will grow up' with them, but continue to be more shy than they. When they are of an age to breed, all the does, except one or two, should be withdrawn, and shortly these will be with young; they may then be removed and some of the others brought back. The hare will after this be generally kept by himself, and the doe will be brought to him at night, when all is quiet, and a covering will be put over the bars of his hutch.

It appears that the number of the young at a birth depends on the sire as well as on the dam: a doe-rabbit put to a hare, instead of rabbit, will bring forth five to eight, instead of eight to twelve young ones; and again, as already stated, a buck hybrid of half-rabbit blood increased the numbers of the quadron litter. This stock has now been kept up through some fourteen or fifteen generations, and in consequence of the pains which have been taken to avoid too much of breeding "in and in" they have not fallen off in size or appearance.

M. Broca speaks of M. Roux as a gentleman who has no pretensions whatever to scientific knowledge, and yet reports that his whole account of the course of events tallies exactly with that which an enlightened physiologist, familiar with the laws of "*Hybridity*," would have anticipated under the circumstances; and this he considers to be in itself strong evidence of the truth and accuracy of his statements.

If our readers who are breeders of stock, have had patience to proceed thus far, a word may suffice to point out to them that, whatever be their flock or herd, they have a personal interest in the broader features of this subject. Extreme cases are best qualified to throw a light upon the mysteries of cross-breeding, and to aid the investigation of the "laws of hybridity." The less the affinity, the broader the contrasts between the two parents, the more manifest and distinct will be the part which each plays in moulding the nature of the offspring.

The hare and the rabbit are so little akin, that the idea of any fusion between them has been a stumbling-block to orthodox science. If we are satisfied that both the buck-rabbit and doe-hare, and also the buck-hare and doe-rabbit, have been successfully brought together, either of these two phases will be worthy of examination, and the one will illustrate the other. M. Roux's hybrids of different degrees, originating with the doe-rabbit, have all had white flesh, like that of the rabbit in colour, though different in flavour (Gagliari's, bred from the doe-hare, had red meat); their coat is said to resemble the hare in its texture, but its colour is

intermediate, a reddish grey ; the ears are as long as those of the hare, with this peculiarity, that in many instances one ear is erect, the other pendent ; their heads are larger than those of the rabbit, the eye more prominent and placed nearer to the nostrils ; the hind-legs are said to resemble the hare (Prof. Owen's report, as we have seen, differed in this respect), the fore-legs are longer ; the length of tail is intermediate. The rabbit-blood, through the male or female alike, appears to give and maintain a prolific character, that of the hare to impair it.

From such considerations M. Broca has been led to adopt a distinction in the physical constitution, suggested by Bichat, between the relative (or animal) life and the organic (or vegetative) life, and to consider that in hybrids the former is chiefly influenced by the sire, the latter by the dam. The expression "*relative life*" seems intended to signify all that tends to bring the animal into *relation* with external objects—the organs or instruments of perception, will, locomotion, sensation ; whilst on the *organic life* depend digestion, secretion, nutrition : that is to say, the formation of tissues through the blood in like manner as wood is formed by sap, whence organic is nearly synonymous with vegetative life.

One illustration of the use to which such curiosities of physiology may be put by farmers may serve as a fitting conclusion to this statement. We have lately had before our eyes an interesting lecture on the breeding and management of sheep from Mr. Woods, agent to Lord Walsingham. The practical aim of this address is especially manifested by the special notice it directs to cross-breeding, as generally practised in Norfolk, rather than of the management of his Lordship's first-rate South-down flock.

Mr. Woods raises the question whether farmers should not rather put a down-ram to long-woolled ewes than continue to follow the converse practice. Now, if the flesh distinctly takes after the dam, and "the consistence of the pelt" be that of the sire, it would seem that we should lose rather than gain by the change suggested. So far as quality of flesh is concerned, the down-ewe is decidedly preferable, for the butcher values dark meat, particularly in young animals ; so far as perception, and will, and sensation influence the temperament, a placid long-woolled sire will answer best. With respect to the wool, there may be a doubt whether we should refer its character to the sire or to the dam ; yet this theory appears to support the preference given to the sire bearing a heavy fleece. At all events, breeders may get some food for meditation from the records of Cagliari's and Roux's respective forms of hybrids.

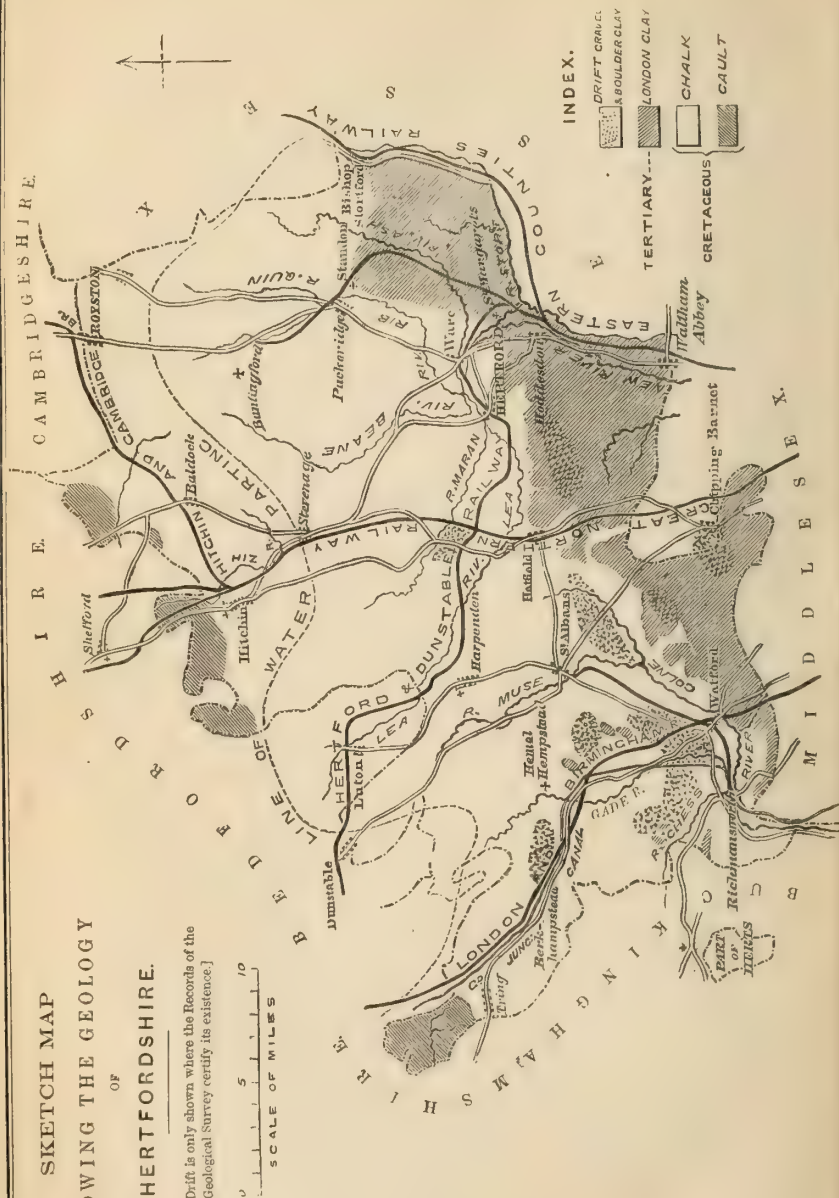
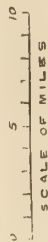
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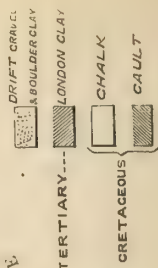


# SKETCH MAP OF HERTFORDSHIRE.

[The Drift is only shown where the Records of the Geological Survey certify its existence.]



## INDEX.



XII.—*Agriculture of Hertfordshire.* By H. EVERSIED.

## PRIZE ESSAY.

HERTFORDSHIRE enjoys the climate of an inland southern county. Its soil is generally of fair quality, and capable of being made productive by liberal farming. It is rich in woods and timber, which, if not conducive to improved farming, are by their luxuriance evidences of good land, and must be reckoned among those local attractions which have caused an unusual number of country seats to be scattered over the county.

The soil, which, except when the chalk comes to the surface, is clay, or a mixture of clay, loam and gravel, oftener heavy than light, is usually well provided with natural drainage by the numerous streams, by inequalities in the surface, and by the chalk substratum which underlies nearly all the county at various depths.

The proximity of London has for generations given a stimulus to some branches of its farming; and of late years fresh encouragement has been derived from railways and the increased requirements of the metropolis. The population in 1851 was 173,962, in 1861, 177,452. The area is 428,143 acres.

We are obliged to Mr. H. Thurnall, of Royston, for the following statistics on the climate :—

RAINFALL at ROYSTON, in HERTS, during the Years 1860, 1861, 1862, and 1863.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Remarks.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	
1860	2·591	1·130	2·176	1·379	3·413	4·451	1·419	3·847	3·031	1·211	2·431	2·476	29·556	Above average.
1861	1·299	2·057	1·912	0·826	0·969	1·90	3·291	0·650	1·032	1·083	3·424	1·362	19·815	Below do.
1862	1·709	0·409	3·066	1·833	2·992	1·993	1·188	3·033	2·009	2·698	1·411	1·523	23·928	About do.
1863	2·792	0·522	0·668	0·595	0·953	2·479	0·530	2·191	1·980	1·696	2·396	1·066	17·868	Below do. (dry year).

The average yearly rainfall for Royston is about 24 or 25 inches.

Although Royston is remarkable for the *number of days* on which rain falls, it nevertheless constitutes one of the driest parts of the county, as the following Tables (taken from Mr. G. J. Symons's well-known yearly accounts of British Rainfall) will show :—

Stations.	Authorities.	Height of Rain Gage.		Depth of Rain.				
		Above Ground.	Above Sea-level.	1860.	1861.	1862.	1863.	
Hertfordshire:—		ft. in.	feet.	inches.	inches.	inches.	inches.	
Watford . . . .	R. Littleboy, Esq. .	5 6	200?	35·00	20·19	26·79	Mr. Symons's Report for the year 1863 is not yet published.	
Watford House . .	R. Clutterbuck, Esq. .	1 6	..	..	..	27·52		
Eastbury, Watford		0 3	..	..	..	27·30		
Fitch's Weir, Hod-	N. Beardmore, Esq. .	2 0	82	..	21·98	25·72		
desdon . . . . .								
Gorhambury . . .	Mr. Bogue . . . .	2 9	..	34·08	22 13	29·16		
Hemel Hempstead .	J. Dickinson and Co. .	3 0	250	34·22	21·20	27·44		
Berkhamstead . .	W. Squire, Esq. . .	1 6	370	36·24	24·10	29·50		
Hitchin . . . . .	W. Lucas, Esq. . .	2 0	..	..	..	22·52		
Royston . . . . .	H. Wortham, Esq. .	0 7	267	29·56	19·81	23·93		

The South-midland Counties (including Hertfordshire), the Eastern Counties, and Middlesex, are the driest counties in England.

### *Soil and General Aspect.*

If we except two patches of green sand with a little gault on the borders of Bucks and Cambridgeshire, the chalk formation occupies the whole of the county to the north of a line drawn from a point just north of Bishop's Stortford, through Ware, Hatfield, St. Albans, and Rickmansworth.

A stranger, however, on observing the chalk cropping out in the deep lanes and cuttings might easily be misled as to the general quality of the soil; but the prevalence of the bare fallow and the absence of the tinkling sheep-bell ought soon to undeceive him. The land here is chiefly arable.

The remaining portion of the county south of the chalk formation, and bordering on Essex and Middlesex, consists of London and plastic clay. Here the clays and loam are generally of greater depth, and better suited for pasture. The Middlesex corner of the county is almost entirely devoted to grass-farming, and the making of hay for the London market. In this district the staple of the land is occasionally deep and fertile, as in the nurseries at Sawbridgeworth, where the fruit-trees have under them 10 feet of good loam. \*

The richest tract in the county is said to be the sandy loam in the valley of the Lea, from Hoddesdon to Cheshunt. This spot is specially appropriated to market-gardening and to nurseries.

Some of the worst land is in several parishes east and south-east of Stevenage, where the clay is of a poor, wet, hungry description, which cannot easily be improved.

Around Hatfield, Myms, and Northam, is a considerable tract marked in Arthur Young's map of the soils "poor gravel." That



eminent writer himself occupied a farm in the parish of North Mymms, and describes it in these graphic words: "I know not what epithet to give this soil; sterility falls short of the idea—a hungry, vitriolic gravel. I occupied for nine years the jaws of a wolf. A nabob's fortune would sink in the attempt to raise good crops in such a country."

It is remarkable that the hedges and timber are thrifty, and show no sign of "sterility." This is owing to the subsoil being cool, and favourable to their growth. The real sterility—for this character is still retained—is partly owing to the mechanical condition of the surface-soil, a mixture of sticky clay with the gravel, which, cementing together, scarcely suffer the water to pass into the chalk rock below. Though, after being drained, the land dries more rapidly, even then its mechanical texture is not sufficiently altered to admit of treading by sheep in winter.

Chalking is practised here with great advantage.

As a whole, the county is heavily wooded. On some estates a great improvement has been effected by removing superfluous fences; but the land, especially when heavy, is often encumbered with trees to an extent quite incompatible with good farming.

The strip of thin chalk land crossing the northern part of the county, with its wide open fields and turnip and sheep farming, is so suggestive of Cambridgeshire that the boundary of the counties at Royston may well be passed without being remarked. The natural division is found in the hills near Therfield, on the great north road, when you plunge at once into Hertfordshire proper, with its woods, small enclosures and heavily-timbered fences.

We desire to give an accurate account of the usual system of farming without needlessly dwelling on defects; and this is not an easy task. In general, on every variety of soil, good and bad management are blended together with such slight shades of difference that a picture of their general aspect could hardly be drawn, and if drawn would be unreadable. It is easy, however, as well as agreeable to find for description examples of skilful management, such as alone are worthy of being copied.

### *Management of Light Land.*

The greatest extent of light land is to be found in the southern half of the county. The situation of the district within twenty-five miles of London greatly influences the farming, and particularly the stock-keeping, since much of the produce, such as roots, wheat-straw, and clover-hay—which elsewhere are made into manure at home—are here sold with greater advantage. Still, good examples of the skilful fattening of cattle in yards

may be found even here. As the land is unfit for permanent pasture, and the clovers are sold for hay, but few sheep or stock of any kind are kept in the summer. In winter the fattening of early lambs has long been practised; some home-bred tegs or store-sheep, bought in the autumn, are also sold fat in spring.

The common *rotation of crops* is—1. Roots; 2. Barley; 3. Clover (or mixed grasses); 4. Wheat; often followed by, 5. Oats. Sainfoin, laid down for three years, is common.

The *Fallow-Crop*.—A few tares are grown for horses, followed by white turnips for the ewes and lambs; trifolium has been tried, but it is not liked as sheep-feed, and as hay is coarse and unsuited for the London market. Rye for spring-feed is occasionally grown; but this and other stubble-crops are generally disapproved, as interfering with the necessary tillage and with the main fallow-crop. Mangold is grown to a small extent, and is invaluable for the ewes and lambs in April and May. Swedes are the main fallow-crop. Their cultivation in Herts was considered by Arthur Young to be in an advanced state, owing to the command of manure: artificial manures have now neutralised this advantage. Three ploughings are usually given, commencing with a 6-inch or 7-inch furrow in autumn, by three horses, on wide lands. In spring the furrow is turned back, and the scarifier is used as often as may be necessary. The field is then set out in ridges. 27-inch bouts are the most convenient width for the dung-cart. A good marker is made by removing from Garrett's horse-hoe the beam which carries the hoes, and substituting one with the marking-shares at the required width. About 10 tons of dung per acre are laid in the furrows, which, when the land is in good order, are made and closed up with the double-breasted plough; 2 cwts. of superphosphate are drilled with the seed. When artificial manure only is used the rows are 24 inches apart, and about 4 cwts. of superphosphate are used. This is the usual system; when higher farming is practised,  $1\frac{1}{2}$  cwts. or 2 cwts. of guano in addition are sown in the ridges.

Repeated horse-hoeings are given. The cost of hand-hoeing is 6s. 9d. per acre: viz. chopping out the young plant, 2s. 6d.; singling by women and children a week after, 1s. 3d.; after-cleaning, 3s. That part of the crop which will not be used before Christmas is partially heaped and earthed in the field at 7s. per acre, topping and tailing included. An old-fashioned practice, not abandoned though inferior to the last, is drawing out a trench or furrow, every 4 yards, with two deep bouts of the plough, *placing* the swedes, with their leaves and roots on, side by side in the furrow, and then ploughing back the earth to them. The root and top are thus kept alive, and the bulb in great measure protected from alternations of frost and thaw. In mild

winters it answers very well, but in a long severe frost the frozen roots are for a time unfit for use and after the thaw are much injured in quality.

Mr. Thomas Smith, of Sandridge, has made a good fallow on dry land with his steam-cultivator by the following simple operations. The stubble-ground, smashed twice after harvest, was left till spring, and then harrowed and scarified by horses to draw out the weeds; steam-cultivated again in May, and then ridged-up by horses and dunged. The swedes were a pretty good crop, and better than if moisture had been lost by frequent ploughings. Autumn cultivation has its advocates, but among its opponents are many able farmers who prefer to keep the plough steadily going, turning a good furrow after harvest, instead of merely scratching the surface. Smashing with the steam-cultivator is a different matter.

*Barley.*—Well-folded land is drilled as soon after the first week in January as it is in good working order, with a view to checking the exuberant growth of straw. March is the principal seed month, and much corn is put in later after the ewes and lambs; the middle of April should be the latest date. May sown barley is sure to be inferior in quality and yield. To avoid this, swedes are either finished earlier or carted to the fallows or clovers, and mangold are heaped in convenient situations to succeed the swedes. After the fold a rather shallow furrow is given. In dry weather in March the drill may follow close after the plough, with or without a scarifying, and generally with two harrowings before and two after the drill, besides rolling. Chevalier and long-eared Nottingham are the sorts most in favour;  $2\frac{1}{2}$  bushels to  $3\frac{1}{2}$  bushels of seed per acre.

*Destruction of Charlock.*—Charlock is here a troublesome weed: hoeing and weeding are the usual, but incomplete, remedy. It is far better and cheaper in the end to take two successive green crops and employ the interval in alternately sprouting and destroying the store of seed in the soil. Weedings are expensive and injurious both to corn-crops and to the clover or grass seeds. (The best crop for the second year's fallow is mangold.) It should succeed the latest-fed swedes, after one ploughing, with a dressing of 2 cwts. of guano and 2 cwts. of superphosphate per acre. If it be drilled a yard apart, and the plough used between the rows all the summer, immense quantities of charlock-seed will vegetate and be destroyed, and a bulky crop of mangold is almost ensured. Wheat or barley follows, and will require a light dressing of guano. The acreage under corn is thus for a time reduced, but ample compensation will be found in the value of the mangold crop, in the greater yield of corn per acre when the land is thoroughly prepared, and in the abatement of an

abiding nuisance. By this and similar methods we have seen a farm entirely cleaned of this weed where it was once as "natural" as on other lands still summer-clad in the brightest yellow.

*Clover, Sainfoin, &c.*—Red clover or cow-grass is not a safe crop oftener than once in eight or ten years; 12 lbs. of seed are mixed with 6 lbs. of trefoil and sown with the hand-barrow; a seed-barrel fitted to a corn-drill saves 3 or 4 lbs. of seed per acre. Alsike is seldom grown alone; for admixture it may be recommended as producing a heavy hay-crop. Stock do not much like it in the green state and it yields no after-crop; but it will grow vigorously on "clover-sick" land, and if required to stand two years will yield as bulky a crop the second year as the first. The usual mixture of seeds is, of white clover 5 or 6 lbs., and of trefoil 15 lbs. per acre, mown for hay and afterwards fed by stock-sheep. Red clover is mown twice, if the second crop is worth it. The hay is made on the swath to preserve the leaf; it is turned 6 or 7 days after cutting, and cocking is avoided unless the weather is fickle. The average crop is  $1\frac{1}{2}$  loads for the first crop, and  $\frac{3}{4}$  or 1 load per acre the second crop.

*Sainfoin.*—4 bushels per acre of seed are drilled in spring-corn, 7 inches apart. It is ploughed up, after three years, with a deep furrow for oats, or occasionally for wheat. The objections to a longer layer are the increased cost of cleaning the land and the risk of wireworm in the next crop. Manure is seldom given. The common sainfoin is preferred for general cultivation; the giant variety is the best to lay down for one year only. The first crop is heavy, though coarse for hay; and the after-crop, stalky and inferior as feed or hay, is usually saved for seed, and yields an average of 2 quarters per acre. It is easy to thrash, and is worth about 40s. per quarter. The common sainfoin comes rather later for hay, and, as the first year's crop is not a full one, 8 lbs. of trefoil are sown with it to supply the deficiency. The after-crop, which is too late and short for hay, makes beautiful feed. The sheep should be removed by Michaelmas, to allow the plant to make some aftergrowth; if close cropped, it would rot off at the crown in winter. Common sainfoin, if saved for seed, must be fed until the beginning of June like red clover, but here the hay is the most paying crop.

*Wheat* is drilled 7 or 8 inches apart in the row. The lea is ploughed, when sufficiently wetted by rain, with a 5-inch furrow, and is sometimes pressed by the common "presser," or consolidated by using the Cambridge or Crosskill Roll. A stale furrow is preferred for the seed. The usual seeding on the chalk soils is large, 8 to 12 pecks per acre. Forty or fifty bushels of soot, costing 7d. per bushel, is a very common top-dressing when no dung is used; it is sown at a



cost of 2s. 6d. and a quart of beer for a hundred bushels. Soot is said to bring on the wheat gradually up to harvest, guano to force and keep it green and growing too long. Soot is, however, very liable to adulteration with sawdust charred by copperas and with ground cinders, &c., and the growth it induces under these circumstances is much more *gradual* than is desirable! Two cwts. of guano sown at seed-time, or in January or February instead of April, is found to be a better and safer manure. Wheat is rolled or clod-crushed in spring to set the young plant and make it tiller. It is not hoed unless the land is foul, but it is sometimes harrowed to destroy annual weeds. Red varieties are the safest, though after favourable seasons white wheats come more into favour. Mixed white and red seed is liked, and sells readily. On light chalk and gravel land red Lammas wheat is esteemed for its soft fine straw, suited for plaiting. The straw is drawn by hand from the sheaf in the barn, and after the ears have been cut off it is sold to the villagers at 1d. or 1½d. a lb., sometimes realizing nearly as much per acre as the corn. Twenty-eight bushels of wheat is considered an average crop.

*Oats.*—The wheat-stubble is ploughed, with a furrow of 7 inches by 3 horses soon after Christmas: the land, if ploughed earlier, is liable to get overrun with grasses. Black Tartarian oats are drilled as early as February, and the red or early grey oats as late as the 1st of April. Canadian oats are unproductive except on very rich land. Scarifying previous to drilling is seldom needed: neither dung nor artificial manure is generally applied, though no crop yields a more certain return for outlay in guano than oats; 2½ cwts. per acre applied at the time of sowing Tartarian oats frequently doubles the produce. Such a bulky crop has the collateral advantage of keeping under charlock and other weeds. Many intelligent farmers consider that the management of the fifth crop, opposed as it is to the sound principle of keeping the land in improving condition, is the weakest point in the farming of this county. "To have the last crop of your course the best" is a homely maxim, full of meaning. The whole system of management should have this aim in view; for the cost of restoring condition to land is always greater than that of keeping it in good heart. The crop of oats after wheat without dressing seldom exceeds 5 quarters per acre; with liberal farming 7 to 9 quarters are as easily obtained. Winter oats are grown to some extent to relieve the spring work and to extend the period of harvest; 3 to 3½ bushels per acre are sown from the middle of September to early in October.

*Fattening Lambs for the London Market.*

On a stock-farm of 300 acres about 200 Hampshire ewes are bought in July or August. They are kept on stubbles and layers as long as the feed lasts, and are then removed to the turnips. White turnips are considered best for milk at the first stage; but later, when the lambs begin to eat, swedes are preferred, as being sounder and better food both for them and the ewes. Hay-chaff is always given before lambing. Lambing commences in the middle of December, and should be over by the middle of January. The lambs fall in a fold, and, if strong, are removed with their mothers to the turnip-fields in a few days. As soon as the lambs begin to eat they are supplied with cut swedes, oil-cake, beans, and cut-clover chaff, *ad libitum*. Oats, maize, and white or partridge peas are partially used. The ewes are also supplied with an unlimited quantity of similar food, oil-cake being preferred. The object is to sell them as soon after the swedes are finished as possible, since clover and summer forage are too valuable for hay to be spared for them. As soon as the lamb is of an age to eat freely, the ewe begins to thrive fast, and with such liberal treatment is fat by the middle of May. The best plan for late feeding is to remove the swedes or mangold to the stubbles and clovers.

The horned Dorsets, which are sometimes kept, drop their lambs a month earlier than others. A few of them are sometimes mixed with a Down flock, under the impression that they incite them to earlier breeding. They are more prolific than other breeds, and their lambs are larger, but only make the same price per head as the Downs: 5 stones of 8 lbs. is a fair average weight for the latter, and nearly 7 stones for the Dorsets.

Of late years 34s. to 35s. per head has been the average price of well-managed flocks, the first sales of the best lambs reaching 40s. The lambs were formerly all sent to market in one-horse carts, and are still frequently so conveyed. The sales commence at twelve weeks old. The Oxford Down ram has been tried lately, and also the Shropshire, but Southdown rams are preferred; close-coated lambs fating faster, and selling more freely. The essentials in a good ram for this branch of breeding are, a deep and heavy carcase, good quarters, and short wool.

*Management of Heavy Land.*

The greatest extent of heavy land is found in the northern half of the county, and south of the Hitchin and Royston chalk-hills.

Of this tract the eastern half is the heaviest and purest clay,

often free from stones (which is not elsewhere the case), and least intermixed with spots of light land.

There are a few large farms, but the average is under 300 acres. The woods are a feature of this district: the farms generally are too much burdened with hedges and timber, and the fields too small.

The usual rotation is:—

1. Fallow, or roots.
2. Barley, or sometimes wheat.
3. Clover.
4. Wheat.
5. Oats.

Or,

1. Fallow, or roots.
2. Wheat or barley.
3. Clover, or beans.
4. Wheat.

The latter is most common on the Essex side of the county, where bean-cultivation is most in favour. Of late years the growth of winter-beans has increased considerably, and restricted the five-field course, an advantageous change in most instances, as it admits of better tillage, and the more frequent use of the hoe.

Stock-keeping and the growth of roots have here occupied quite a secondary place.

Two opposite methods have of late been adopted for improving on the common system: the increase of returns from corn, by more efficient tillage, and the use of artificial manures; or else the growth of roots and rape for early folding, or for feeding in yards, or on the clovers in early spring. Without here discussing the merits of the two systems we may observe that the root-cultivation which some heavy-land farmers have successfully practised is never remunerative unless accompanied by a thorough knowledge of the art of stock-feeding.

The high price of stock has led to a pretty general increase in the root-crops, of which a few acres are now grown on most farms (though not usually under very liberal management), to help the making of straw into manure. Store-cattle are then wintered in the yards, or they are fatted off on cut roots, oil-cake, and sometimes meal, cotton-cake mixed with straw-chaff. Hay is more frequently sold than used at home. Pigs are bred and fattened to a small extent.

Farm-horses are generally bought out of Lincolnshire and elsewhere. Twenty years ago it was common to buy in young horses of  $2\frac{1}{2}$  or 3 years old from the midland counties, keep them at half work, and sell them at five years old, well fed up, to the London draymen. But this trade has entirely died out, the constant care and favour which the colt requires being incompatible with the requirements of such tillage-farms.

Though neither the breeding nor the fattening of sheep is carried out to a large extent, most of the better farms have a flock of ewes, generally Hants Downs. The Coltswold tup is most in favour; Leicesters and Lincolns are also used. The ewes are folded on turnips, with some dry food, such as malt-combs, with straw-chaff, or trefoil "stover;" (*i. e.* the straw after thrashing the seed).

The lambs are dropped between the middle of January and the middle of February. After lambing, the best managers give the ewes a little oil-cake or a few oats; neither beans nor cotton-cake are liked for suckling-ewes. Most farmers now grow some mangold, to be given to the ewes with dry food on the young clovers. Lambs are weaned early in July, and are well kept on the mixed clovers and on sainfoin, wintered on roots, and sold fat after being shorn. They get cake or corn early in autumn, or sometimes from weaning time. The half-bred lamb will, with such treatment, weigh 10 to 11 stones at 15 months old, and will sell for 60s., paying 1s. a week from birth. Such early feeding with corn should, however, never be commenced unless it can be steadily maintained, with a due admixture of green and dry food. The value of the purchased food is sacrificed by any check.

The ewes are usually fattened; and this is generally desirable, because an old Hampshire crone, which cost from 40s. to 44s., is worth when poor after shearing only 25s. to 28s. If fattened after weaning-time, they are put on the freshest after-crop of clover and sainfoin, with a pint of beans daily, or 1 lb. of cake, and finished off on rape or early turnips. Of late years, the high price of old ewes and the danger of bringing the foot-complaint into the farm has led to the purchase of younger sheep, which are kept several years.

The half-bred ewe lambs are sometimes drafted into the ewe flock, and are either coupled with a long-woolled ram, or a west county Down. The excellent constitution and general good character of the half-bred ewe is an inducement to adopt this practice, which, however, requires caution. A lamb, mongrel to the third generation, must have been bred under the auspices of a very skilful breeder if he be not a worse animal than one of the first cross. Such stock often make bold-looking, well-sized lambs; but in the spring they prove more scanty in their proportions, longer in the leg, and lighter both in wool and carcass than better bred tegs.

*Fallow Crops.*—The tillage here given differs from that of the light lands by two additional cross ploughings in spring, and the use of the broad share on a stale furrow, just before drilling, which is done from the middle of May to the middle of June.



The stubble after the fifth crop is not unfrequently, though not necessarily, in a foul state, and filled with the imperishable seeds of charlock, the weed of the district. To destroy this pest the land cannot be moved too often, provided the crop of seeds brought to the surface has time to vegetate.

Autumn cultivation, by broad-sharing the stubble, is practised to some extent in fine seasons.

Swedes are sown on lands ploughed 12 feet wide, so as to be drilled by a bout with the Suffolk drill. The use of superphosphate is universal for turnips: guano is added to the other manures under liberal farming.

Some white turnips have of late years been sown and folded early, and followed by wheat. Hand-hoeing is let at 7s. an acre, to include singling and weeding. The intervals are kept clean by the horse-hoe, which is often improvised by detaching the mould-board from a common plough, and adding a broad-share behind.

On the heaviest land, swedes, if grown at all, are drawn to the yards; and one of the largest sheep-farmers assures us he has been compelled to abandon folding later than November, even on well-drained heavy land, to avoid injury to his barley. The weight of swedes per acre on these soils, and in this dry climate, is very small. Some informants estimate the crop at 10 tons per acre; but with average management and seasons it is probably less. With the best treatment 18 tons of cleaned swedes per acre can be looked for only in a favourable year.

The cultivation of mangold has increased in the last seven years, but has received a check by two or three unfavourable seasons. The system of autumn-manuring and *cultivation* in spring, without turning in the well-weathered surface, has been introduced with unquestioned benefit: two ploughings in autumn and winter are advisable to break up the land, which then works better in spring. The breadth grown is restricted by a general impression that they exhaust the land. Is it not meant by this that they yield a heavy crop compared with swedes, and therefore leave less for the succeeding crop? On highly-farmed land, on the contrary, mangold is considered a good preparation for corn.\*

Fallows are still made with five or six ploughings; and adjoining Essex, the one-yard ridges are common. This system is well described in detail by Mr. Raynbird, in the 8th vol. of the Journal, Part 2. On land well drained the ridge is not quite so prevalent as formerly. Foul land is perhaps more

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\* So long as I carted off the leaves I found a difficulty in growing corn after mangold, even with the aid of artificial manures: a good dressing of tops, ploughed in, removes this difficulty even on light land.—P.H.F.

easily cleaned by a summer fallow on the ridge than by any other process of horse-tillage.

In the same locality clod-burning in summer is practised. About 20 to 25 bushels are burned in heaps about 4 rods apart. The ashes are spread and ploughed in with a shallow furrow. The cost is 2l. per acre. The scourings of ditches, and parings of banks and hedges are also burnt and applied to fallows, 30 or 40 loads per acre. Fallows not so treated receive either a light coat of dung, applied at a leisure time, before harvest; or about 2 cwt. of guano, or 5 cwt. of malt dust per acre, at the time of sowing the barley; or 1½ cwt. of nitrate of soda in May. The land is technically said to be "worn out" previous to the fallow, and to require renovating by some of these methods.

*Barley.*—3 to 3½ bushels per acre are drilled as soon as the land is in fit condition. The drill is preceded by the scarifier; or if the land is free from deep-rooted weeds, by harrows only. Ploughing the fallows in spring, which was formerly thought essential to good farming, is now avoided: the success of the crop depends on keeping the weathered surface at the top and in effecting all the spring operations in dry weather. If heavy rain falls on the fresh furrow, or even at the time of sowing, before the land has become dry and coated, a hard surface-crust will be formed which seals up the young plant. Barley after mangold, with about 2 cwt. of guano, is preferred to late sown wheat, and yields a good quality. Hoeing is not common. Guano for barley is occasionally sown on the fallow in autumn. An early application of ammoniacal manure is always beneficial in preventing the over-luxuriance of straw; but the best practice is to harrow it in in February, or early in March.

*Clover, Sainfoin, Trefoil for Seed, Beans.*—The two former are grown for hay, with the same management as elsewhere detailed.

Winter beans are increasing in favour as a substitute for clover, and, under good management, are a convenient and profitable crop. The main points are, never to grow them on land out of condition; to put them in, by drill or dibble, as early as the first week of October, and to keep the land perfectly clean by hand and horse hoeing. One ploughing at harvest, or even broad-sharing only, leaves the land in good order for wheat. The deeper the staple of the soil the better for them. Dung is always applied to them, unless it had been given to the previous crop of barley. The rest of the dung is applied to roots, where they are grown; or otherwise to the fallow for barley and to the clover leas. Trefoil is grown alone, and saved for seed. A dressing of dung or soot, or guano, is always applied after it; and the wheat is not the worse for the seed-crop if the land was in good heart.

Five quarters of seed per acre is a good crop. It is sold at 24s. or 25s. a quarter to factors, and prepared by them for market.

*Wheat*.—The most common varieties are golden drop, Bowles' prolific, Spalding; on the borders of Essex and on the colder heavier lands, Rivett, a bearded wheat (seed about  $2\frac{1}{2}$  bushels per acre); rough chaff white is sometimes sown: time of sowing, the second week in October to the second week in November; width of row 6 inches to 8 inches: not much hoeing: a large number of acres dressed with about 40 bushels of soot per acre.

*Oats* are frequently grown after wheat, as elsewhere detailed.

### *Chalking.*

This ancient practice (for it has prevailed as far back as the history of the county extends) appears to rest its merits almost entirely on its mechanical effect on the soil, to which, however, can hardly be attributed the disappearance of may-weed and sorrel from lands that have been chalked. The common remark is, that the dung-cart should follow the chalking, which is usually applied to a fallow for roots. On the other hand, the occasional complaint of injury by chalking also rests on the mechanical effect—as, for instance, in the case of wheat, when a frost, acting on a heavy coat of chalk, has loosened the surface, and either lifted the plant or caused it to be root-fallen; or in the case of roots, when the process has been deferred till the season is too far advanced for the land to be got into good condition for turnips. The mechanical effect consists in rendering heavy land more mellow and easy to plough, and gravels less liable to burn. On either description of soil chalking is still a general and approved practice. The work is done by chalk-drawers, who charge  $5\frac{1}{2}d.$  per load of 20 bushels, and 1s. a load for stones, supposing the shaft not to exceed 12 feet in depth; this price includes spreading (worth  $\frac{1}{2}d.$  per load) and filling in the shaft. One man at the bottom of the shaft raises the chalk and fills the bucket, another winds it up, and two or three, with barrows, drive it away so as to cover 4 to 6 acres, laying it in rows and in bushel-heaps to facilitate the account. The shaft is then filled in, the top soil being in the first instance thrown back and then replaced after the hole has been filled up with subsoil. Early winter is the proper season for the work, and the barrowing is most easily done on unploughed land. Chalk, like burnt earth, should be kept near the surface; it is well therefore to give a shallow furrow in early spring, and a deeper one afterwards. The usual dressing is, from 50 up to 70 loads per acre; the benefit extends over many years, so that the same occupier seldom chalks the same field twice; and his grandson may very

possibly feel that benefit, even in a county where yearly holdings are the custom! Half the quantity mentioned is sometimes preferred, as lessening the first outlay, and lasting the average duration of a tenancy.

### *The Thin Chalk (Hill) District.*

This is a narrow strip passing through the northern part of the county, from Royston through Sandon, Baldock, and Hitchin to Stopsley, in Bedfordshire. The only circumstance which connects the farming of this small and exceptional tract with that of the rest of Hertfordshire is the traffic in farm produce with London, aided by the Hitchin to Royston railway. Town manure is delivered on the route at 7s. 6d. per ton, and has been used to much advantage on the farms near the stations. Wheat-straw is sent to London; not much hay is made, the clovers and sainfoin being in request for sheep-feed. The common four-course rotation prevails. Sheep are the manure-carriers. The turnip-crop is grown by artificial manures alone, the dung being reserved almost entirely for the wheat-crop, and applied to the clover leas soon after harvest, when it may be seen like a coat of thatch, scorched by the sun and apparently wasted; yet the plan has long been sanctioned by the leading farmers of a first-rate agricultural district, who find that it conduces to a sound crop of wheat. This practice, as well as early ploughing, which suits the wheat plant, expedites the labour of the farm; and on clean land, where the skim-coulter will work, there is no occasion to plough the leas more than once. The benefit of an early furrow may always be noticed in a field where the work has been begun and interrupted; on the earlier ploughed strips the wheat-plant looks greener through the winter, and at harvest the straw is brighter, and the grain more yielding. The system of stock-feeding rules the cropping of the fallows; yard-feeding is quite subordinate to the sheep-fold. On most farms a mixed breeding and fattening flock is kept. The usual plan is to buy in every year Hants or West County Down ewes, which are put to a Cotswold or other long-woolled ram, and fattened; the lambs are weaned in June and sold, or occasionally the ewe lambs are drafted into the flock. As the land is not warm and early enough for stubble green crops, the main dependence for food is on the turnip-crop. A few tares are grown for horses, and a few mangold for spring use.

### *The Hay Farms.*

The hay farms, which occupy a considerable area in Middlesex, occasionally extend over the border, as at Barnet, and from



Pinner to Bushey, on the edge of the London clay basin. The boundary line of this formation is everywhere defined by the verge of the grass, which terminates with the out-crop of the chalk. It may be clearly seen from the London and North-Western Railway before reaching Watford; and the division is the more marked at this spot because the diluvial deposits covering the chalk are gravelly loams unsuited to pasture.

The whole farm is usually mown every season. Well-rotted dung is applied between November and the end of January, at the rate of 10 to 15 tons per acre every second or third year. The average crop is estimated at 1 to  $1\frac{1}{2}$  loads of hay.

Villa residences, occupied by families from London, have largely encroached on these grass farms.

The rent, said to be 40s. to 50s. per acre, is higher than such poor heavy clay would yield under arable culture, and at the present price of corn, there is no inducement to break up any portion of the grass. A hay farm is, however, in many respects undesirable, and less productive than it might be. There is but one crop, and that a precarious one; the aftermath is fed at a disadvantage if stock has to be bought at that particular season, and resold as soon as the feed is off. Moreover, the extra labourers required for the hay season can only be tempted by high wages to come from a distance. Such farms are most advantageously occupied by London cow-keepers, or by men who eke out their income by other employment. Their winter occupation is chiefly carting hay to market, and bringing back dung.

#### *The Trade in Farm Produce with London.*

Hay and straw are sent to London from all but the most remote parts of the country, and most Hertfordshire farmers are occasional sellers of both. Neither the marketing nor the carting is usually done by the grower, who disposes of his produce to local dealers, and the carting is done by men who make this their especial business. Hay is seldom sent by rail, as it arrives in market in better condition when taken direct in the one-horse cart; and even straw is largely sent by the road. The cost of carriage for a distance of 20 to 25 miles is 12s. per load of hay (36 trusses of 56 lbs.), and 8s. per load of straw (36 trusses of 36 lbs.). A one-horse load is 18 cwt. Under the impulse given by any rise in price, these bulky articles may frequently be met on the road thirty miles or more from London. The carters start in the afternoon in time to reach the market on the following morning; and, after delivering their load to the salesman, they collect their return load of manure or soot, and com-

mence their journey so as to reach home at night. A return freight of soot (about 80 bushels to the one-horse load) is worth to the carter from 10s. to 12s. When soot, or a freight of greater value, cannot be procured, dung is collected from the different stables at a cost of about 1s. per load. At the farm it is considered worth from 7s. to 7s. 6d. The manure frees the carter from all tolls.

We extract the following clause from an Herts' Agreement, showing the usual obligation of the tenant who sells hay and straw:—"Clover, hay, and wheat-straw may be sold off upon returning, in the same year, a waggon-load of dung or other manure of equal value for every load of hay or straw sold or taken off."

This privilege, which is merely the liberty to sell in the dearest market, is liable to abuse by those who improvidently dispose of that which is their own stock-in-trade, as well as their landlords' safeguard. Such men, however, even when bound by restrictions, to "spend and consume," &c., upon the farm, always manage by some inevitable process to reduce their farms to the lowest ebb of producing power. In intelligent hands this traffic has in many instances permanently raised the condition of the land, and occasionally, in situations favourable for railway transit, has altered the general aspect of the neighbourhood. The occupiers of some such farms have been enabled to double their produce, and more than double their gross receipts. So much more profitable may be the marketing of produce and the purchase of manure than making meat and manure at home.

On some few estates, situated near a railway, the tenant is allowed to sell roots if he bring back 1 ton of London dung for every ton of roots sold off.

Mr. John Ransome, of Wheathampstead, formerly the able manager of Mr. Lawes's farm at Rothamsted, has placed at our disposal the following details. His farm, lying close to the station, contains about 445 acres, including 25 acres of pasture. The greater part of the arable is strong clay, and not adapted for feeding roots on the land. Upwards of 1000 tons of dung made by 200 omnibus horses, eating about 3000 qrs. of corn, are brought on to the farm in a year. If we deduct one-third of this for waste the effect is practically the same as if 2000 qrs. of corn, besides hay, were used in feeding stock on this farm. Mr. Ransome uses in addition about 400l. worth of guano, superphosphate, and wheat-manure. This liberal treatment is rapidly raising the condition of the farm, which had been much reduced. Bare fallow has been hitherto necessary to clean the land, but roots will shortly form an important item in the sales. Mangolds are this year sent to the London dairies at 21s. per ton

delivered at King's Cross station; cost of carriage 4s. per ton. The price would, in consequence of the partial failure of the turnip-crop, have been higher but for the large supply of potatoes. The only stock required to be kept is a sufficient number of cows to tread down the barley and oat-straw. The produce in milk is sent by rail to London.

On calculation, it was found that the first idea of establishing a dairy on a more extended scale, and sending the milk to London, would prove less profitable than the system just detailed.\*

The usual price paid in London for dung is  $2\frac{1}{2}d.$  per horse per week at the stable, if within a mile of the station—equal to about 3s. 6d. per ton on the rail. The buyer carts the dung; the railway charge brings the cost to about 6s. 6d. per ton delivered to the station, at a distance of 25 miles from London. 2d. per ton is deducted for the carriage of quantities of 500 tons in a year, and 3d. per ton for 1000 tons. The manure from omnibus-stables is frequently spread at once on the land; that from livery-stables, where more litter is used, must either be carted on heaps or spread in the yard.

There are several dairies in the neighbourhood of Hatfield, where many cows are kept for the purpose of supplying the London market with milk, which is conveyed in tin cans by railway night and morning. The buyers are principally wholesale dealers; but smaller quantities are bought by retailers. The price varies from 1s. 3d. to 1s. 5d. per barn-gallon of 17 pints, the buyer paying carriage. The cost from Hatfield to London ( $17\frac{1}{4}$  miles) is 6d. per can, containing 9 gallons or less imperial measure.

#### *Mr. Lawes's Farm at Rothamsted.*

The readers of the elaborate papers in which the results of the Rothamsted experiments are recorded can have no adequate conception of the exact and laborious system by which those results are obtained.

The experimental farm and laboratories are conducted on a scale that gives them rather more the character of a public institution than that of a private undertaking. About 50 acres of arable land and 6 acres of pasture are devoted entirely to the purpose of successive experiments on various crops. The results of these investigations find a sufficient record in the series of able and exhaustive papers published in this Journal. We will, therefore,

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\* Mr. Ransome contracts for the manure made by 72 omnibus-horses in one establishment, where the daily provender is as follows:—3 qrs. of oats;  $4\frac{1}{4}$  bushels of beans; 13 trusses of clover-hay;  $\frac{1}{4}$  load, or 9 trusses of straw for litter (36 lbs. per truss).

## ROTHAMSTED FARM.—JUNE, 1863.

SUMMARY STATEMENT OF THE PRESENT AND PREVIOUS CROPPING, &amp;c.,\*

NAME OF FIELD.	Acres.	Cropping and Manuring.	
		1850.	1851.
BARN .. .. .	28 {	Turnips, Dung—Artificial.	Wheat, Unmanured.
THIRTY ACRES .. .	30 {	Mangolds, Dung—Artificial.	Wheat, Unmanured.
UPPER HARPENDEN .. .	14 {	Wheat, Artificial.	Barley, Artificial.
HARPENDEN .. .	22 {	Wheat, Artificial.	Barley, Artificial.
LITTLE HOOS .. .	9 {	Wheat, Artificial.	Clover, Unmanured.
FOSTERS' .. .	18 {	Clover, Unmanured.	Wheat, Folded.
KNOTT WOOD .. .	30 {	Clover, Unmanured.	Wheat, Unmanured.
LITTLE KNOTT WOOD .. .	14 {	Wheat, Folded.	Barley, Artificial.
SAWPIT .. .	14 {	Wheat, Folded.	Tares, Dung.
RICK-YARD .. .	8 {	Mangolds, Dung—Artificial.	Wheat, Unmanured.
SIX ACRES .. .	6 {	Turnips, Artificial.	Wheat, Unmanured.
CLAY-CROFT .. .	5 {	Turnips, Dung—Artificial.	Wheat, Unmanured.
APPLE TREE .. .	18 {	Clover, Unmanured.	Wheat, Folded.
TEN ACRES .. .	10 {	Tares, Dung.	Wheat, Unmanured.
PARK FIELD .. .	10 {	Mangolds, Dung—Artificial.	Wheat, Unmanured.
AGDELL .. .	9 {	Clover, Unmanured.	Wheat, Artificial.

\* The cropping, as given in the Summary, is for 247 acres of arable only—the farm having been only recently increased to its present size.

† Eight acres of Barn-Field (now Barley) were devoted to the successive growth of Turnips with artificial manures from 1843 to 1852 inclusive, the tops and roots being always carted off the land, and the last two crops (1851 and 1852) being grown with mineral manures only. Barley has been grown each year since, the present being the third crop without manure



ROTHAMSTED FARM.—JUNE, 1863.

THE ARABLE LAND NOT UNDER EXPERIMENT.—(14 Years, 1850-63, inclusive.)

Cropping and Manuring.

1852.	1853.	1854.	1855.
Barley, Artificial.	Oats, Artificial.	Wheat, Artificial.	Oats,† Artificial.
Barley, Artificial.	Trefoil, Unmanured.	Wheat, Folded.	Mangolds & Swedes, Dung—Artificial.
Mangolds, Dung—Artificial.	Wheat, Unmanured.	Wheat, Artificial.	Wheat, Artificial.
Clover, Unmanured.	Swedes, Dung—Artificial.	Barley, Unmanured.	Wheat, Artificial.
Wheat, Folded.	Barley, Artificial.	Mangolds & Turnips, Dung—Artificial.	Wheat, Unmanured.
Barley, Artificial.	Fallow & Turnips, Artificial.	Wheat & Barley, Artificial.	Trefoil, Unmanured.
Turnips, Artificial.	Barley, Folded.	Trefoil, Unmanured.	Wheat, Artificial.
Trefoil, Unmanured.	Wheat, Folded.	Barley, Unmanured.	Beans, Dung.
Wheat, Unmanured.	Barley, Artificial.	Swedes, Dung—Artificial.	Wheat, Unmanured.
Barley, Artificial.	Clover, Unmanured.	Wheat, Folded.	Tares, Dung.
Barley, Folded.	Oats, Artificial.	Wheat, Artificial.	Swedes, Artificial.
Oats, Artificial.	Oats, Artificial.	Beans, Dung.	Wheat, Unmanured.
Barley, Artificial.	Turnips, Dung—Artificial.	Barley, Unmanured.	Wheat, Artificial.
Turnips, Artificial.	Barley, Folded.	Clover, Unmanured.	Wheat, Folded.
Trefoil, Unmanured.	Wheat, Folded.	Turnips, Artificial.	Barley, Unmanured.
Tares, Dung.	Barley, Unmanured.	Beans, Dung.	Wheat,‡ Unmanured.

(excepting a portion round the outside which is manured with 1 cwt. of Nitrate of Soda), the object being to grow a Corn crop until the organic manures of the different Plots are equally exhausted.

‡ Part of Agdell under the Rotation of Turnips—Barley—Clover (or Beans or Fallow)—Wheat; with various Experimental manures applied for the Turnips. The present is the last crop of the second course of the above Rotation.

SUMMARY STATEMENT OF THE PRESENT AND PREVIOUS CROPPING, &c.—*continued.*

NAME OF FIELD.	Acres.	Cropping and Manuring.		
		1856.	1857.	1858.
BARN .. .. .	20 {	Turnips, Artificial.	Wheat, Artificial.	Oats, Artificial.
THIRTY ACRES .. .. .	30 {	Oats, Artificial.	Red Clover (peren.), Unmanured.	Wheat, after Sheep-Folding.
UPPER HARPENDEN .. .. .	14 {	Turnips, Artificial.	Barley, after Sheep-Folding.	Beans, Dung.
HARPENDEN .. .. .	22 {	Red Clover, (peren.), Unmanured.	Wheat, Artificial.	Oats, Artificial.
LITTLE HOOS .. .. .	9 {	Oats, Artificial.	Turnips, Artificial.	Wheat, after Sheep-Folding.
FOSTERS' .. .. .	18 {	Wheat, Artificial.	Barley, Artificial.	Swedes, Artificial.
KNOTT WOOD .. .. .	30 {	Oats, Artificial.	Swedes, Dung & Artificial.	Barley, after Sheep-Folding.
LITTLE KNOTT WOOD .. .. .	14 {	Wheat, Artificial.	Oats, Artificial.	Swedes, Dung & Artificial.
SAWPIT .. .. .	14 {	Red Clover (peren.), Unmanured.	Wheat, Artificial.	Oats, Artificial.
RICK-YARD .. .. .	8 {	Oats, Artificial.	Mangolds, Dung & Artificial.	Wheat, Unmanured.
SIX ACRES .. .. .	6 {	Barley, after Sheep-Folding.	Trefoil, Unmanured.	Wheat, after Sheep-Folding.
CLAY-CROFT .. .. .	5 {	Oats, Artificial.	Beans, Dung.	Wheat, Artificial.
APPLE TREE .. .. .	18 {	Swedes, Dung & Artificial.	Oats, after Sheep-Folding.	Red Clover (peren.), Unmanured.
TEN ACRES .. .. .	10 {	Barley, Artificial.	Tares, Dung.	Oats, Unmanured.
PARK FIELD .. .. .	10 {	Wheat, Artificial.	Red Clover (bicn.), Unmanured.	Wheat, after Sheep-Folding.
AGDELL .. .. .	9 {	Barley, Artificial.	Tares, Dung.	Oats, Unmanured.

SUMMARY STATEMENT OF THE PRESENT AND PREVIOUS CROPPING, &c.—*continued.*

Cropping and Manuring.

1859.	1860.	1861.	1862.	1863.
Red Clover (peren.), Unmanured.	Wheat, after Sheep-Folding.	Swedes, Dung & Artificial.	Oats, Artificial (2 cwt. Guano).	Red Clover (peren.), Unmanured.
Oats, Artificial.	Swedes, Dung & Artificial.	Oats, after Sheep-Folding.	Red Clover (peren.), Unmanured.	Wheat, Sheep-Folded (2 cwt. Guano).
Wheat, Artificial.	Barley, Artificial.	Swedes, Dung & Artificial.	Oats, after Sheep-Folding.	Red Clover. Unmanured.
Swedes, Dung & Artificial.	Oats, after Sheep-Folding.	Red Clover (peren.), Unmanured.	Wheat, Artificial (2 cwt. Guano).	Oats, Artificial (3 cwt. Guano).
Oats, Artificial.	Mangolds, Dung & Artificial.	Oats, Unmanured.	Barley, Artificial (2 cwt. Guano, 1 cwt. superphos.).	Barley (3 cwt. Guano, 1 cwt. superphos.).
Barley, after Sheep-Folding.	Red Clover (peren.), Unmanured.	Wheat, Artificial.	Oats, Artificial (3 cwt. Guano).	Barley (5½ cwt. Manure).
Red Clover (peren.), Unmanured.	Wheat, Artificial.	Oats, Artificial.	Swedes, Dung & Artificial.	Oats, Sheep-Folded.
Oats, after Sheep-Folding.	Red Clover (peren.), Unmanured.	Wheat, after Sheep-Folding.	Oats, Artificial (3 cwt. Guano).	Swedes, Dung & Artificial.
Mangolds, Dung & Artificial.	Oats, Unmanured.	White Clover, Unmanured.	Wheat, Artificial (2 cwt. Guano).	Tares & Oats, Sheep-Folded (2 cwt. Guano).
Oats, Artificial.	Tares, Dung.	Oats, Unmanured.	Mangolds, Dung & Artificial.	Wheat, Unmanured.
Barley, Artificial.	Beans, Dung.	Wheat, Unmanured.	Oats, Artificial (3 cwt. Guano).	Mangolds, Dung & Artificial.
Oats, Artificial.	Red Clover (peren.), Unmanured.	Wheat, Artificial.	Beans, Dung } & Fallow.	Wheat, Dung.
Wheat, Artificial.	Oats, Artificial.	Mangolds, Dung & Artificial.	Wheat, Unmanured.	Laid down in Grass-Seeds.
Tares, Dung.	Oats, Artificial.	Red Clover (peren.), Unmanured.	Wheat, after Sheep-Folding.	Oats (3 cwt. Guano).
Wheat, Artificial.	Oats, Artificial.	Red Clover (peren.), Unmanured.	Wheat, Artificial (2 cwt. Guano).	Oats (3 cwt. Guano).
Barley, Artificial.	Garden- ground.	Oats, Unmanured.	Tares, Dung.	Barley, Sheep-Folded.

therefore, confine our attention to a survey of the system of management adopted on this demesne farm of a Hertfordshire landowner who possesses in an eminent degree the practical qualities requisite to make such an undertaking successful.

The Home Farm consists of about 450 acres, including 94 of park. The soil is a strong loam on a clay subsoil resting on chalk at a depth of about 12 feet, and sufficiently dry without artificial drainage. Chalking has been here practised by the method already described.

One or two fields were drained, with the idea that they might be sufficiently altered in texture to admit of their being folded by sheep in winter without injury to the land. The result, however, only confirmed Mr. Lawes in the opinion that on such strong soils barley after winter folding is an unsafe crop, owing to the mechanical condition of the land, which is not corrected even by the frost.

“Barley,” to quote Mr. Lawes, “will generally succeed better on this land after wheat than after roots, provided it receives a proper application of artificial manure.” The artificial manures for corn-crops are sown and harrowed in with the seed, and top-dressings are avoided as far as possible.

So wide an interest is felt in this well-known farm that a detailed summary of its cropping may be of service. (See pp. 286-9.)

NUMBER OF ACRES in various CROPS in each of the 14 Years.

Years.	Wheat.	Barley.	Oats.	Beans.	Roots and Tares.	Clover and Grasses.	Total Acres.
1850	73	..	..	..	97	75	245
1851	172	50	..	..	14	9	245
1852	23	103	5	..	63	46	245
1853	38	72	39	..	58	38	245
1854	95	63	..	14	33	40	245
1855	131	10	28	14	44	18	245
1856	42	25	82	..	52	36	237*
1857	56	32	32	5	66	46	237
1858	68	30	75	14	32	18	237
1859	42	33	66	..	46	50	237
1860	50	14	74	6	56	37	237
1861	43	..	86	..	52	56	237
1862	74	9	72	5	47	30	237
1863	43	36	72	..	34	52	237
	950	482	631	58	694	551	3366

The following is a Summary of the Number of Acres in Corn, in Beans, and in Green Crops in each of the 14 years :—

\* Eight acres appropriated in 1856 to experimental purposes.



## SUMMARY OF CROPPING.

Date.	Corn Crops.	Beans.	Green Crops.	Total.
1850	73	..	172	245
1851	222	..	23	..
1852	136	..	109	..
1853	149	..	96	..
1854	158	14	73	..
1855	169	14	62	..
1856	149	..	88	237
1857	120	5	112	..
1858	173	14	50	..
1859	141	..	96	..
1860	138	6	93	..
1861	129	..	108	..
1862	155	5	77	..
1863	151	..	86	..
	2063	58	1245	3366 Acres.

The average yearly acreage of each crop has been :—Corn,  $147\frac{5}{4}$ ; beans,  $4\frac{1}{7}$ ; green crops,  $88\frac{3}{4}$ .

An excess of horse-power is necessarily kept for occasional work connected with the estate and the experimental lands, giving a reserve force which can be concentrated on the farm when needed. Without this reserve, or that of steam, the above system of cropping would not be practicable. The fallows for roots are broken up in the autumn, with three or four horses, to a depth of 9 or 10 inches; ploughed back in spring, then twice across, and *bouted* in 27-inch ridges. Swedes get 12 tons of dung per acre, and mangold about 25 tons of dung; of which, part is applied in autumn, and the remainder in spring. 2 cwts. of guano are sown on the dung, and 2 cwts. of superphosphate drilled with the seed. Mangolds are drilled the last week in April, Swedes the first week in June. They are horse-hoed, and cultivated in the usual way in all respects. The crop of Swedes averages 15 tons; of mangolds, 30 tons per acre. Both are commonly drawn off the land. Salt has on this land proved even injurious as a manure for mangold. We saw a field just previous to storing (1863) where a trial of different weights of salt has been given at rates varying from 5 to 10 cwts. per acre, and in every instance the leaves looked yellow and the roots were smaller than when the salt was omitted, and the injurious effect was greater in proportion to the quantity of salt given. Wheat usually follows the roots after a 5-inch furrow, 2 bushels of seed per acre. Browick and Rostock (red varieties) are drilled in 9-inch rows from the first week in October till the end; average crop, 35 bushels per acre.

Chevalier barley usually follows wheat, or other corn, and proves of better quality than when grown after roots. The land is ploughed once with a 6-inch furrow, usually in December, and  $2\frac{1}{2}$  bushels of seed per acre are drilled, in 7-inch rows, in February or March; 2 cwts. of guano and 1 cwt. of superphosphate is the usual dressing. The crop averages 6 quarters per acre.

Tartarian oats are drilled after corn, 7 inches apart, with once ploughing; 4 bushels of seed per acre, 2 cwts. of guano, and about 1 cwt. of sulphate of ammonia. Red and Canadian oats are drilled after roots; 3 to 4 bushels of seed per acre, with 2 cwts. of guano. The Tartarian are sown in February, and the average crop is 10 quarters per acre. The red oats average 8 to 10 quarters; and the Canadian, which are the last sown, 6 to 9 quarters.

All the corn-crops are rolled in spring; they are kept clean without hoeing.

A good deal of straw is used for the estate and to thatch the little stacks on the experimental plots; some is sold.

A flock of 200 Southdown ewes is kept on the grass-land, or on clover with mangold, and during the winter is brought into well-littered yards for the night. The details of management are the same as on any other well-managed heavy-land farms.

At present there is no indication of diminution in the productive power of the land. Corn undoubtedly bears frequent repetition on the same land better than roots, even if they be folded on the ground. Of this we saw a marked instance near Rothamsted. By grubbing up a fence some ill-farmed land, which had not been in roots for many years, was added to one of the fields cropped with turnips in the usual rotation. The whole field, similarly treated as to manure and tillage, was sown with swedes, and these, though healthy throughout, were more vigorous in growth and proved a heavier crop on the new land.

The practical lesson taught by this branch of Rothamsted farming is, that on strong land corn crops are more profitable than green crops; and that they may be repeated on such land for a series of years, without the usual intervention of fallow crops, with no apparent decrease in the productive power of the land. To carry out this system two conditions are essential,—a reserve of mechanical power on the farm, and a proper use of artificial manures. Mr. Lawes has endorsed his opinion and practice by letting a farm of 400 acres for 21 years without restrictions as to cropping.

One instance of a farm in which, by the aid of steam-cultivation, great and rapid improvements have been effected, deserves some exceptional notice. In the autumn of 1861, Mr. John

Prout, of London, bought about 450 acres of good heavy land near Sawbridgeworth, and proceeded with great spirit—making it an example of the improvement that may be effected in a short time with the aid of steam-cultivation—to clear away hedges, drain the land, fill up ditches, construct roads, and form reservoirs to feed the engine.

A considerable quantity of the draining was done by one of the steam mole-ploughs of Mr. Edington of Chelmsford. The depth was 28 inches and width 14 feet, and the contract 35s. per acre, exclusive of digging and piping the main drains, which cost 5s. per acre. Owing to the wretched condition of the land it was thought advisable, instead of growing wheat on the outgoing tenant's fallows, to give them a second year's fallow. This was done by repeated ploughing and cultivating with a 14 horse-power engine, including ploughing and subsoiling to a depth of 14 inches. About 100 acres of Rivett wheat were sown without dressing, and, as might be expected after the two years' fallow and with the remarkably productive harvest of 1863, the crop was very heavy, reaching 8 quarters an acre on some portions that at the present date have been thrashed. The crop on well-farmed lands, of this description of wheat, was, in some instances, equally heavy; the extraordinary season, in fact, levelled the distinctions of management. In future years we do not doubt that the benefit of thorough tillage with liberal farming will become even more apparent in the average quantity of corn that the farm will produce.

The Home Farm of the Earl of Essex is remarkable for an extensive experiment on sewage brought from the adjoining town of Watford. The pipes were laid down eight years ago. The population from which the sewage is derived is about 4500; this does not include the whole parish. Pipes are laid under 96 acres of land, comprising 35 acres of permanent pasture, 7 to 10 acres of Italian rye-grass, and the rest arable. The soil of the neighbourhood is chiefly dry and gravelly, though this particular spot is rather less light than the average. The pumps are worked by a 12 horse-power fixed engine, and throw daily 60,000 to 70,000 gallons, which if applied to one acre of land would moisten it to a depth of 3 inches. In practice, the whole of the sewage is applied during the winter to the 35 acres of permanent pasture, and early in March it is turned on to the rye-grass, and is confined entirely to that crop as long as it continues in growth. Cutting commences when the rye-grass is 1 foot high, which, in 1863, was on the 11th of April; and, as fast as the land is cleared, it is again irrigated daily, receiving a greater or less quantity, according to the quantity of ground cleared. Five cuttings are obtained, and the crop of the year varies from 30 to

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50 tons of green fodder. Growth is much assisted by cloudy and showery weather, and is checked by a dry scorching season. The quantity of stock maintained is 18 or 20 horses and 15 beasts; they eat the rye-grass with avidity, and the oxen need no other food while it lasts. They are fattened off on swedes, chaff, and 2 lbs. of linseed-meal, or 6 lbs. of oilcake. A lot of Welsh cattle, bought in the autumn of 1862 at 6*l.* 6*s.*, which had the run of the Park in the winter, were fed on sewage-grass from April till the autumn, and then received the mixture of roots and cake as stated above, realised, at Christmas 1863, the average price of 20*l.* 10*s.*

At the Home Farm the urine from 30 shorthorned cows is collected in a tank, diluted with water pumped from the river, and directed over 4 acres of Italian rye-grass. The cows graze over 30 acres of pasture during the night in summer, and are fed in yards on the rye-grass during the heat of the day; and this 34 acres of land suffice for their maintenance, without other food, until autumn. The total acreage of the Farm (exclusive of the Park) is 231 acres of arable and 120 acres of grass; the whole of the grass, except the 30 acres, is mown every year for hay. The winter stock consists of 120 head of cattle in the yards, and a flock of 250 pure Southdown ewes and their progeny. The arable land is well and highly farmed, without much regard to rotation. About one-third of the land is in roots, and a good crop of these is, on this light, gravelly soil, considered essential to good after-crops. Two covered homesteads were erected on this farm three years ago, on an excellent plan combining economy, convenience, and comfort for a large herd of cattle.

We give the following detailed account of the farming of Richard Oakley, Esq., of Lawrence End, as an example of what may be done on heavy land by summer feeding and early folding.

The corn crops on this farm are very heavy: 10 quarters of oats per acre after wheat are often grown in a locality where half that quantity is the general average. We believe Mr. Oakley finds, under his system of high-feeding, that the barley crop is getting too strong for quality. He will probably have to crop a little faster with corn.

Mr. Oakley writes—

“I have in my own occupation about 1200 acres, about 1000 acres of which are arable, chiefly a heavy loam; the rest, grass of a poor, weak kind; but with liberal supplies of cake or corn I manage to fatten some well-bred, moderate-sized Herefords, which greatly improves the grass.

“My principal crops are wheat and barley: but I sow some 30 or 40 acres of black Tartarian oats, top-dressed, after clover-lea wheat. I do not sow red clover oftener than once in 8 or 10 years, substituting trefoil to be fed off with sheep on cake or corn; the land ploughed up early in summer and sown with



rape (dressed with superphosphate), which is fed off by sheep with cake or corn in September or October, and sown with wheat. I sow 20 or 30 acres of winter tares on some of the strongest land for the horses, pigs, &c.; and, when they are off, the land is cultivated and laid up in ridges for mangold in the following spring. This enables us to get the mangold in early, whatever the weather may be. In April I begin to put in some early turnips, with 3 cwt. of Laives's manure, on some of the wheat-stubbles on the strongest land, sowing about 3 acres every fortnight. I do not risk sowing many acres together so early; for, although mildew seldom affects them, they become *putty* if they are not eaten at the proper time. We generally begin them early in August. Some few acres are sown with spring tares, for fear that keep for the lambs may run short before the turnips are quite ready; these are eaten off with cake or corn, and the land made a tilth for barley.

"I put 300 Hampshire Down ewes to a Cotswold ram. They are now lambing, and the lambs born in February are weaned early in May and put on trefoil, having the first run. Some store-sheep are put behind them to clean up what they leave. The ewes are fattened off every year. The lambs have cake or corn all the summer, and, until they go to market at 11 to 13 months old, shorn. I have already sent 130 to market, which sold from 48s. to 53s. each; these cut 8 lbs. of wool each. As soon as the ewes have lost their milk they are put on good keep and fattened off, and a fresh lot bought at Overton Fair on the 18th of July.

"Getting rid of my home-bred tegs so early, I am often enabled to buy in others advantageously in the early spring for summer-feeding; 50 of the best of the Down lambs so bought and kept to the age of 21 months, averaged last Christmas 5*l.* 3*s.* 6*d.* each. Mr. Slater, of Kensington, had 24 of them at 5*s.* 8*d.* per stone, which averaged 18 stones 2 lbs. each.

"As to oxen, I put off two lots in the year, one from the grass and the other from the yards. Forty or fifty well-bred polled Scots were bought at Barnet Fair in September, which run on the grass till about 1st of November, when they are put into small, well-sheltered yards, 8 or 10 in each. They begin with 3 or 4 lbs. of cake, and go up to 10 lbs. each. They have clover-hay and wheat-straw chaff cut together; 1 bushel of cut swedes or mangold and half a peck of ground beans are mixed with the chaff. They are sold fat from April to June (according to the beef-trade) to some London butchers. Last year they weighed 115 to 130 stones, and made 5*s.* 4*d.* per stone.

"We put about as many store-pigs in the yard as there are oxen, which live chiefly on what the oxen drop. A polled Scot requires to be in yards 5 or 6 months to make him good, and will then have made manure enough to dress an acre of ground, and this I value at 4*l.* I generally have about 20 young shorthorns sent me from Durham in May: they are about 2 years old, very poor, and cost from 10*l.* 10*s.* to 11*l.* 10*s.* They go behind the Herefords, eat up what they leave, and remain grazing about till Christmas if the weather continues open. They are then shut in yards, have a couple of bushels of cut swedes or mangolds a day and  $\frac{1}{2}$  peck of ground beans mixed with wheat-straw chaff until they are turned out for summer grazing, when they have either cake or corn with the grass, and they generally go off about August. Last year they averaged a little more than 108 stones, at 5*s.* per stone.

"I paid last year (in addition to home-grown corn)—

						£	s.	d.
For cake and corn	..	..	..	..	..	1130	6	0
For manures	..	..	..	..	..	269	18	0
						<hr/>		
						£1400	4	0

This was rather less than usual.

"I always endeavour to be beforehand with the work of the farm."

Mr. Oakley also grows early rape in preparation for wheat: 5 lbs. or 6 lbs. of seed are drilled, 14 inches apart, with 3 cwt. of superphosphate per acre. The crop is folded at 8 or 10 weeks old, when about 18 inches high, and while young and luxuriant. At this age the sheep eat it to the ground without waste. Lambs on rape are supplied with clover-hay chaff, even in the hottest weather, and soon eat it freely.

The land is frequently ploughed up after folding, and again sown broadcast and without dressing, and a second crop obtained in time for wheat to follow.

Twenty or thirty acres of beans are grown on this farm by way of change.

Another excellent manager of stock has adopted the following system with profit. He buys cows to calve in January or February; the calves remain with their mothers until both are fat in the following May twelvemonth. They are summered on grass, and the cows get about 5 lbs. of cake daily, or rather less while the grass is at its best. As soon as the calf robs its mother's trough more cake is given, and by November the calves get 3 lbs. of cake each daily, and this is soon increased to 4 lbs. or 5 lbs.; they are wintered on cut roots, cake and meal, and straw-chaff. By May the calves which have remained by their mother's side will weigh about 60 stones, and sometimes more, selling occasionally for 19*l.* at 15 months old.

On farms with good pasture the calves should fall in May; in summer they should be taken into yards with their mothers during the heat of the day, and kept in yards or boxes through the winter and sold to the butcher in June or July. Mangold and lucerne are provided for late spring-feeding. This young beef is not of the best quality, but it is quickly and profitably made. Of course, the calf must be highly fed from birth, and must receive no check. It may be said of this, as of most systems of feeding, "the grazier's eye is worth 4 lb. of cake a day."

The following mixture of food for fattening oxen has been used on a large scale with success.

2 cwts. of meal.		$\frac{1}{2}$ sack malt coombs.
1 " oilcake.		8 sacks chaff.
1 " pollard.		3 lbs. salt.

The composition of the meal varies with prices; at present it consists of

1 sack of lentils.		1 sack of Indian corn.
1 " beans.		1 " oats.

The chaff is one part of good hay, and two parts of the best straw.

The times of feeding, and the quantities for a large ox are—

7 o'clock,	7 lbs. of mixture.
10    ,,	1 bushel of roots.
3     ,,	7 lbs. of mixture.
5     ,,	7    ,, of hay for the night.
Two pails of water.	

*Draining.*—Here, as elsewhere, the work of draining has been variously apportioned between landlord and tenant. If the landlord incurs the whole outlay and charges a per centage, a new letting affords the best opportunity for its execution, since the addition of interest to rent is not much relished by occupiers, even for a permanent improvement.

The following examples, taken from the large experience of Mr. Humbert, of Watford, will show how the work is generally executed when the landlord charges a per centage on the outlay. At Haydon Hall, near Bushey, 3 feet 6 inches deep, and 24 feet apart. At Bushey House (a stiff London clay), 3 feet, and 3 feet six inches, by 24 feet and 30 feet. At Hadham Park, near Stortford, and land adjoining, 4 feet by 24 feet and 30 feet. At Walkern, near Stevenage, 4 feet by 30 feet and 40 feet apart. The land in the last instance is a diluvial clay, with water-worn chalk stones, boulders, and a great mixture of soils; advantage is therefore taken of a comparatively open subsoil to increase the intervals and diminish the outlay. When the tenant does the whole the drains are commonly made 30 inches deep, and  $5\frac{1}{2}$  to 7 yards apart.

Some diluvial clays lying on the chalk, open in texture to a depth of 20 inches to 28 inches, and resting on a tough clay subsoil impervious to water, are converted into excellent barley lands by draining them 24 inches or 30 inches deep, and one rod apart. The advocates of this system maintain that by placing the outlet no deeper than the meeting between the close subsoil and the more porous surface soil, the land is most effectually freed from superfluous water. Shallow drainage, chiefly by bushes and straw, is an ancient practice on such land, but has been largely supplanted by the mole plough, aided as it now is by the steam engine, which is recommended by its efficiency, economy, and speed in executing a large quantity of work. It has sometimes been maintained by the grass farmers that drainage lessens the quantity of hay, though confessedly it improves its quality and sweetens the pasturage. On the other hand, it would be easy to give instances of grass farmers who have been enabled by drainage only to continue the payment of their rents, and who have themselves suggested this improvement to their landlords, from observing its great benefit on adjoining farms.

*Steam Cultivation.*—Steam cultivation is of too recent introduction in Hertfordshire for us to draw any broad conclusions from its operation. We saw, however, six or seven instances in which it had been adopted by enterprising tenant farmers.

We are indebted to Mr. John Smyth, of Newsell Bury, for the following communication:—"My farm consists of about 700 acres of arable, of which 540 acres are light land, and about 160 acres are heavy. The latter, a thin skinned clay, is too heavy for roots, and too weak for beans. The whole is farmed mainly on the four-course system, but 40 acres are kept in sainfoin, which stands for four years. I have an eight-horse engine and Smith's tackle; with this, in harvest, or as soon after as possible, I proceed to break up my light land stubble, taking for choice any that may be grassy. After exposure to the sun this is crossed with the larger implement, and then cleansed from rubbish, and finally laid up for the winter in ridges by horse labour. A heavy set of harrows across in the spring, and the use of the broad share will complete the tilth for turnips, which are drilled with superphosphate, dung having been applied to the layers for wheat in July, August, and September. After the foul land has been dealt with, the layers must be broken up for wheat sowing. On my light soil these layers should not be smashed up, because we require the solidity which an unbroken furrow slice affords; early sowing is also desirable. Having reduced my horses from eighteen to fourteen, I determined to add to my steam tackle Howard's three-furrow plough, which makes first-rate work, and enables me to push forward the wheat sowing when the foul stubbles are cleared and rain has mellowed the clover layers. Later in the season I find that the plough makes the best work in preparing the clean light land for roots; it gets over five acres per day, at a depth of six inches. In the following March the furrows are crossed with Smith's large implement, working rather deeper than the plough. In May or June the broad share is used to cut down thistles and annual weeds; harrows, and the Cross-kill roller follow, and the turnips are drilled immediately.

"When fallowing heavy land for wheat, if it be foul, I leave it untouched until February or March, when I generally smash it up nine inches deep with Smith's small implement, and leave it lying rough until a favourable opportunity, or until the steam cultivation is finished on the light lands, when, say in the month of May, I cross the work by steam, going down this time to twelve inches. The land lies rough again until the summer rains have softened the clods, when a heavy set of harrows will at once form a tilth. I then apply farmyard manure, cut down thistles by the broad share, and harrow down just before the wheat is drilled. Forty acres of wheat growing on land treated exactly as I have



described are looking strong and well. The land is well drained, and there is not an open furrow in the field, neither is any required. Previous to my entry on this farm (eight years since) this class of land was miserably wet, ploughed four inches deep on small lands, about three yards wide, with water furrows innumerable. The remaining portion of fallow (the clean heavy land) is ploughed by horses, during the months of December, and January and February, at a time when the engine is wanted at the homestead; if it be smashed by steam during the summer a good tilth will be the result.

“A clean wheat stubble intended for a crop of spring corn should be managed thus: Harrow the stubble to cause the seeds to vegetate, plough up by horses immediately after wheat sowing, do nothing more until the drilling in the spring. If the land be light the less you break up and expose it to the atmosphere the better. I have known many instances in which an extra ploughing, or a too deep scarifying has ruined the chance of a crop. Heavy land might be advantageously smashed directly after harvest, and then treated as above. My engine ploughs, cultivates, thrashes, and grinds the corn, cuts chaff, and sifts it, breaks oilcake, splits beans, crushes oats, and, in fact, makes itself generally useful.”

### *Miscellaneous.*

Harvest-work is done on several plans; either both cutting and carting are done by the day, or else the cutting is done by the piece, and the carting by the day, the labourer receiving six or eight pints of beer; more commonly the whole business of cutting and carting is let to a gang of men, allotting 10 or 12 acres to each, and paying 10s. or 11s. an acre. Under each plan a labourer's earnings in harvest amount to 5*l.* 10s. or 6*l.* 10s.

Though task-work is generally desirable, not only on the score of economy but for its influence on the habits of the labourers, still large gangs of men working together are objectionable. This is especially the case in harvest, when its tendency is to encourage extravagance in beer, and induce young labourers to make slovenly work in order to keep pace with the more practised hands.

Reaping is fast being abandoned; three-fourths or more of the corn is now mown; a large breadth is cut by reaping-machines. Shepherds who have only the care of a flock in winter make a harvest with the other men, and are paid ploughman's wages (12s. a week) at lambing-time, with beer as their only perquisite: their day-wages average 10s. a week. Near the grass-district double or treble the usual prices are often paid for mowing clover, the demands of the hay-farms causing a scarcity of hands.

The old custom of gift-ploughing prevails in many parts of the county, to help a new tenant on his entry; a circular being sent to friends and neighbours to fix the day. One farmer, popular in his neighbourhood, on entering his farm had 145 ploughs at his gift-ploughing, and more than 100 acres were ploughed in the day.

On the tenure of land little need be said: yearly tenancies prevail, and leases are the exception. Yearly tenancies, terminable at Michaelmas by a six months' notice, are the rule.

The incoming tenant has the right to make the fallows. The notice to quit on the 24th of March is, as regards the fallows, a notice to quit the next day. This is an apparent hardship on the outgoing tenant, since it deprives teams which he must maintain for harvest and other work, of one portion of their regular employment. In practice, however, the incoming tenant finds it to his interest to employ and pay his predecessor for making the fallow while he, as is proper, has the power of regulating the manner in which the work is done.

An objectionable system of selling wheat, peas, and beans by the load of 5 bushels prevails; barley and oats are sold by the quarter. At St. Alban's there is an inconvenient practice of storing in warehouses the bulk of the wheat offered for sale by a sample sack in the market; it is consequently sometimes brought back past the seller's door for delivery to the buyer.

The average crop of wheat on heavy land is estimated at 25 bushels per acre. This, perhaps, is little better than a guess; yet the statement is concurred in by many informants who aim at larger returns. They have not unfrequently added, "We ought, with our system, to average 35 to 40 bushels."

The rents of such land average about 22s.; tithe rent-charge 5s.; and poor's-rate 3s. 6d. per acre.

*Implements.*—Iron-ploughs of modern make are common to the light land: in the heavy-land district the Rayne-plough is popular.

The use of carts for harvest-work is so nearly universal in this county that a waggon in a harvest-field in Hertfordshire is nearly as great a curiosity as a sedan-chair in the streets of London.

A simple lime-sowing machine for destroying slugs in corn, invented by Mr. Thrale, of No-Man's-Land, and made by Mr. Davis, of Hemel Hempstead, is a good deal in use. It consists of a perforated iron-cylinder, in four compartments, to hold the lime. As these revolve the abrasion causes the lime to pass off in very fine particles. Two bushels of hard, unslacked stone-lime are used per acre; and 10 acres may be gone over in a night with one horse. A damp, warm night is chosen, when the slugs

are out. The machine is drawn in the opposite direction to the wind, so that the creatures may get a sufficient dose of the caustic. Without this precaution they would escape on their first irritation by the dust.

At Courson's farm, I noticed that the mangers in the cattle-yard, instead of being fixed, were swung by chains or ropes to the nearest beam; a simple plan, which saves the expense of posts, and facilitates the raising or lowering of the mangers.

Several parishes in the north of the county have been only recently enclosed, viz.: Therfield and Sandon in 1840, and Ashwell, a parish of 4000 acres of good land, as lately as 1862. Baldock and Clothall remain still unenclosed. This appears strange, since the right of sheep-walks over open fields every third year, by preventing the growth of roots, is ruinous to farming on light lands, whereas, after enclosure, the produce of land is often doubled.

A singular example of farming at Letchworth deserves mention. Fifteen hundred acres of good land, which was allowed to run wild to grass twenty-five years ago by the late owner, have maintained in the summer months a herd of 400 or 500 oxen of various breeds, which, in favourable years, have come up in good order for fattening in autumn.

*Farm-Buildings and Cottages* have in isolated cases been much improved, but nothing has been done on an extensive scale. This, therefore, remains a weak point in the agricultural economy of the county.

Good brick cottages, on the model of those erected by Lord Dacre on the farm of Mr. Samuel Jonas in Essex, have been built on the estate of Mr. Fordham, at Sherfield, and deserve special notice when the subject of cottage-building is under consideration. They are in groups of three, with a common bakehouse, oven, and pump. Each cottage has three bed-rooms, and two rooms below, besides the usual offices. They were built by Mr. James Jacklin, of Royston, at a cost of 225*l.* the group, or 75*l.* each, and for neatness of appearance and convenience of arrangement are superior to any we have hitherto known to be completed at such a price.

Covered homesteads have been erected by the same builder at Kelshall, with cheap and durable roofs of corrugated iron, a material almost as light as glass, and therefore requiring very slight scantlings for support. Homesteads entirely or nearly covered may reasonably be expected to pay interest on the cost of their erection, more especially where straw is valuable, since the saving in litter is only surpassed by the greater gain from the superior quality of the dung produced.

*Improvements lately introduced and those still required.*—The

numerous examples of good farming already noticed afford satisfactory evidence of improvement: future progress will very much depend on the extent to which they are imitated, and on the increase of the average amount of farm-capital. Among the improvements specially requiring attention by landlords and tenants, the following may be enumerated:—extended cultivation of mangolds and early turnips on heavy land; the use of more artificial and other manures; a reduction of the cost of cultivation by less frequent and more effective tillage; an increased head of live stock, with a more economical system of feeding; better shelter for animals in yards, and less exposure of manure; care in avoiding to sow the seeds of charlock and other weeds; restriction of the growth of oats after wheat to clean land in good heart; and the enlargement of fields by the removal of hedges and timber, accompanied by a better distribution of woods and plantations, so as to secure picturesque effect without the sacrifice of material interests.

The labourer's condition also demands very grave consideration. The efforts made at Rothamsted and in other parts of the county to improve his lot and raise his social condition are entitled equally to praise and imitation.

### XIII.—*Agricultural Notes on Hertfordshire.* By Rev. J. CLUTTERBUCK.

Agricultural Literature—Climate—Rainfall and Percolation of Water as tested by Dalton's Gauge—Area and Population—Sales of Fat Stock—Physical Geography—Influence of Swallow-holes on Drainage and Water Supply—The Water-level in the Chalk—Sheep Farm at Wheathampstead—The Chalk district—Irrigation—Paper-Mills—Drainage of low Meadows—Water-Cresses—Cherry-Orchards—Woods—Straw-Plait—Seed Wheats—The Bennington Flock—Heavy Roller with revolving Shafts.

#### AGRICULTURAL LITERATURE.

The agriculture of Herts has already been chronicled by Ellis of Little Gaddesden (quoted by A. Young), in 1732; by Walker, in his 'Report prepared for the Board of Agriculture,' in 1759; by Clutterbuck, in his History of this county (1815); but especially by Arthur Young, in his 'Report,' published in 1804.

To that distinguished pioneer in agriculture we are indebted for our only reliable means of contrasting the agriculture of the 18th with that of the 19th century. Of him it has been well said: "If great zeal, indefatigable exertion, and an unsparing expense in making experiments can give a man a claim to the gratitude of agriculturists, Arthur Young deserved it more than



most men. We will not assert that in all cases his conclusions were sound or his judgment unimpeachable, but even his blunders, if he committed any, have tended to the benefit of agriculture by exciting discussion and criticism." \*

The above passage aptly characterises his 'Report of Herts,' which mainly embodies the opinions of the leading farmers, amateur or professional, of that day. Drill husbandry, the cultivation of the Swede turnip, the substitution of the Southdown for the long-legged Wiltshire sheep, were then leading subjects for discussion; and it is remarkable that the introduction of improved implements and practice rests throughout this Report with amateurs, whilst the management of the most common and essential operations of husbandry in the present day will be found to be completely at variance with that of some of the best practical farmers who gave information to Arthur Young.

The name of Mr. T. Greg, of Coles, near Westmill, often quoted by A. Young, deserves a passing notice. Prompted by Mr. Coke's (Lord Leicester's) example, Mr. Greg first undertook, by the aid of Hill's scarifier, to apply, to his own wet tenacious clays the principles of Norfolk husbandry. He abolished the bare summer fallow, ploughing but once for a crop, and that only in winter, using the scarifier, the drill, and the horse-hoe freely to complete his operations.

In proof that improvements in husbandry were early introduced into Hertfordshire, A. Young, quoting Mr. Rooper, of Berkhamstead, says that clover and turnips were supposed to have been introduced by Oliver Cromwell, who "gave a farmer named How a 100*l.* a year on that account," and that there had been little change in the course of cropping for one hundred years.

The climate of England, though it may have undergone some changes, must be essentially the same as when Fuller said of Hertfordshire, "It is the Garden of England for delight; men commonly say that such as buy a house in Hertfordshire, pay two years' purchase for the aire thereof;"—a salubrity due to the geological condition of the greater part of the county, gravel upon chalk.

#### RAINFALL AND PERCOLATION OF WATER.

The following tables of rainfall and mean temperature were kindly furnished by those gentlemen by whom the registry has been kept. The column Dalton's Gauge, under the head "Hemel Hempstead," refers to a rain-gauge, suggested by Dr. Dalton and kept at Apsley Mills for twenty-nine years last past,

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\* *Vide* Kirwin, 'Irish Transactions.'

which only registers that portion of the rainfall which percolates 3 feet of soil. Its construction is described in 'Ree's Cyclopaedia' under the head Evaporation. It is calculated that the amount so collected represents the quantity which sinks through the surface soil to the springs, which supply the rivers and give power to the mills.

The average rainfall registered for 29 years is 22·5, percolation 7·5 inches. The Table shows 25·8 of rainfall and 4·9 percolation for the last 10 years. It will be seen that the amount of rainfall increases with the longitude westward.

BERKHAMSTEAD.			HEMEL HEMPSTEAD.			ROYSTON.			
	°	'	°	'	°	°	'	"	
Longitude W.	0	34	0	27	50	Longitude W.	0	0	2
Latitude	52	45	0	52	45	0	52	2	40
Height above sea, 370 feet.			Height above sea, 250 feet.			Height above sea, 266 feet.			
Years.	Rain.	Mean Temperature.	Rain.	Dalton's Gauge.	Rain.	Mean Temperature.			
1854	24·0	..	18·2	1·4	18·1	49·2			
1855	30·5	45·6	25·8	5·4	25·0	46·7			
1856	30·0	47·7	26·6	7·4	21·9	48·8			
1857	29·2	49·6	28·1	7·4	27·9	50·5			
1858	22·5	48·3	20·5	3·2	20·4	48·9			
1859	33·0	49·3	32·6	4·5	25·4	50·2			
1860	36·2	45·7	34·2	12·1	29·5	46·0			
1861	24·1	48·0	22·2	6·4	19·8	48·5			
1862	29·5	48·4	27·4	8·0	23·9	48·5			
1863	26·7	49·0	22·7	3·3	17·8	49·4			
Average	28·5	47·1	25·8	5·9	22·9	48·6			

### AREA AND POPULATION.

The geographical extent of the county may be taken to be, in length, south-west to north-east, 36 miles; south-east to north-west, 26 miles; with a circumference of from 130 to 140 miles. Halley is quoted as estimating its superficial area at 451,000 acres. The population returns 1861 give it at 391,141 acres. Clutterbuck gives the population, in 1801, 97,577; 1811, 111,654: increase, 14,077. The last returns, 1851, 167,298; 1861, 173,294: increase, 5996. Total increase since 1801, 75,717. The persons employed chiefly in agriculture in 1801 are 20,611. The families so employed in 1811, 16,998.

### MARKETS AND SALES BY AUCTION.

Of the old markets, suffice it to say, that there are 18 market towns in which the old system of selling wheat by the load of 5 bushels is still very generally followed. Barnet fair is still

famous for its supply of neat cattle, brought from Wales and Scotland, &c.

The modern practice of holding sales of fat stock by auction, at such towns as Hitchin, Hertford, Bishop's Stortford, and Watford, has assumed such large and increasing proportions that it may be well to trace its development as exhibited in the town of Hitchin. These sales which were here first held occasionally in 1852, took place in 1853 twice or three times in a month, and ultimately, in 1862, every week. A yard specially fitted for the purpose was opened by Messrs. Page and Harding, 8th December, 1862. Their sales in 1861 realised 65,345*l.* 4*s.*; in 1862, 79,496*l.* 5*s.*; in 1863, 107,014*l.* 0*s.* 6*d.* The sale of Christmas last, December 15, realised 5,118*l.* 9*s.*, and consisted of 108 oxen, 675 sheep, 2 calves, and 44 pigs. In the year 1863: 1876 oxen, 22,492 sheep, 123 calves, 2707 pigs, and 1156 lambs were sold.

#### PHYSICAL GEOGRAPHY.

The boundaries of this county are not, as is sometimes the case, determined by the physical features. On the north, the boundary is generally coincident with the escarpment of the chalk or Chiltern range of hills; on the south-east it is formed by the Lea and its affluent the Stort; to the south it lies very much along the high ridge, where the London clay is partially capped by drift of the Eocene beds; and on the west it follows the ridge overhanging the valley of the Bulborne, in which the Grand Junction Canal finds its course. Thus the agriculture of Hertfordshire in some cases takes its character from the several counties by which it is surrounded, and from which it is divided by an ill-defined and arbitrary line. The geological features of this county are comparatively simple. It comprehends within its limits a considerable portion of the north-western limb of the chalk-basin of London. Here nearly the whole substratum is chalk, the surface of which is either covered with drift gravel, or the tertiary deposits of the London and Plastic clay; a very small part consists of the Gault clay, which, with a trace of the upper green sand, crops out from beneath the chalk.

As the physical features of the surface are necessarily ruled by the geological condition, there is a considerable sameness in the outward aspect of the county, though there is a frequent and marked difference in the nature and quality of the soils.

Speaking generally, the county may be divided into the clay and chalk districts; the former forming the southern portion adjoining the county of Middlesex; the latter extending from the outcrop of the clays to the escarpment of the chalk hills, the frontier of the counties of Buckingham, Bedford, and

Cambridge. The rivers Coln and Lea flowing in opposite directions in part of their course, form a sort of natural division between these two districts, though they do not strictly determine the limits on either side.

In the southern district, the London Clay, is mostly marked by low, rounded undulations, broken by tortuous watercourses, which provide the natural escape for surface-water, and a ready outfall for artificial drainage.

#### SWALLOW-HOLES.

The upper levels are very frequently covered with beds of gravel, which retain a certain quantity of water for the supply of shallow wells, which, as on Bushey Heath, attract a considerable population. The water also finds vent in land-springs at the junction of the gravel with the clay, the feeders of the brooks which run into the rivers Coln and Lea. Occasionally these waters pass, in their course towards the valley, the outcrop of the sand which underlies the clay beds of the Plastic clay formation; it then sinks by swallow or "swilly holes" into the subjacent chalk, and goes directly to augment the springs whence the rivers derive their perennial sources. Very large volumes of water so sink into the earth, and the mischief which would arise from the flooding of these brooks in winter is thus much abated. It has been suggested by very high authority that the perennial supply of water to rivers might be materially augmented if artificial means were used to facilitate the absorption of these waters. Very remarkable instances of this natural drainage may be seen more or less along the outcrop of the sand beds of the Plastic clay formation in the parishes of Bushey and Aldenham. In the watercourse which leads from the reservoir at Elstree, it has been found necessary to stop these swallow-holes to prevent waste.

The construction of artificial swallow-holes deserves our consideration as a means both of maintaining a perennial supply of water to our rivers, and also of facilitating drainage operations on a system suggested more than a century ago by Elkington.

The soil of the upper levels of the clay district marked by the rounded flint-pebbles embedded in the sand is wet and unkindly, not capable of bearing grass of any value, and ungrateful under the most liberal treatment as arable land. This gravel, with its characteristic blue-pebble, is transported in many cases below the higher levels, where the sterility of the soil is in proportion to the thickness of the bed. Where the London clay comes to the surface it forms a stubborn soil, which, however, by draining and a liberal treatment is made to grow abundant crops of grass. It also favours the luxuriant growth of oak, elm, and ash timber.



Immediately beneath the London, the Plastic clay crops out. The upper or clay-beds of this formation, as the name implies, are well suited for the manufacture of kiln-ware; it is more tenacious, and less manageable than the London clay; and usually forms a narrow band on the slopes and escarpments of the hill-sides; the lower beds are of very pure sand, sometimes perfectly white, suited for domestic, horticultural, and other purposes, though some of the beds are interspersed with rolled pebbles. To the breaking up of this stratum much of the soil that covers the chalk is due, and from hence the hard conglomerate known as Hertfordshire pudding-stone is derived. The most fertile spots in this district are found at the outcrop of these strata, where the clay and sand are amalgamated so as to form a friable and kindly soil. The geological condition here described extends more or less in a band across the county from Moor Park, near Rickmansworth, on the west, to its eastern limit bounded by the river Stort.

The neighbourhood of Bishops Stortford furnishes a good example of farming under geological conditions not found elsewhere in this county, but resembling those which subsist in some parts of Essex. The river Stort runs through a trough in the chalk, over which the Plastic clay-formation crops out on the side of the valley. Its beds of clay and sand here amalgamate with the flint-gravel, with which the chalk is covered on the lower levels, to form a light, friable, and fertile soil, suited to four-course husbandry. On the higher levels the tertiary clay forms rather wide-spread "plateaus," covered very generally with a drift consisting of water-worn chalk, with some chalk-flints. This drift, for such it appears to be, is not found in the western parts of the clay-districts of Hertfordshire under the same geological conditions of subsoil, though it is very extensively diffused in Essex, where it presents some of the best corn-land in that county. It would be very interesting to trace the extent of this deposit in both counties, and, if possible, account for its unusual presence as a covering to the tertiary beds resting on the chalk.

#### THE WATER-LEVEL IN THE CHALK.

As in the case of the clays, the chalk-district may be subdivided; it has been so treated by Arthur Young, who, in his maps, lays down the principal part as loam, distinguishing as chalk only that small space which is drained by rivers running to the north with a fall anticlinal to the natural dip of the stratum. Adopting this division, of which it would be difficult to define the exact limits, we find that the southern slope from the northern limits of the county to the point where the river

Coln enters the county of Middlesex, has a total dip of about 350 feet, or from the higher ground in Bedfordshire of 650 feet, which latter point is about 770 feet above the level of the sea. The highest ground on the ridges between the rivers is capped with portions of the plastic clay *in situ*, which may be deemed outlying patches of the clay-district, in some cases covered with gravel to a sufficient depth to retain the water to serve the ordinary wants of villages or hamlets, such as Abbots Langley and Bedmont. Thus the population is found either on the ridge or in the valleys near the rivers, the intermediate parts being dependent on water drawn from deep wells sunk into the chalk.

On the accompanying section, taken on the ridge midway between the rivers Gade and Ver, is shown the depth at which water is found, with its noted alternations at two periods in the same year. The level of the course of the river Gade, with which that of the Ver is nearly identical, is also given between these points. The surface of the subterranean water would be shown by an inclined line, fixed at the river, and more or less elevated or depressed towards the ridge according as the stock of water is augmented by the replenishment of the chalk stratum, or reduced by the natural drainage. Thus in chalk districts the level at which water is found may be accurately ascertained.

The intermediate space between the ridges, and the rivers which run in the valleys, is covered with gravel, often presenting a surface which consists almost entirely of flint-stones, the removal of which, if it were possible, would rather detract from, than add to the productiveness of the soil by quickening evaporation. This soil with slight variations forms the main staple of the district which lies between the outcrop of the London and Plastic clays and the northern limits of the county.

A stranger acquainted with those Western counties which have a soil almost identical with this in its texture and its geological bearings, is here struck by the absence of breeding flocks, the deficiency of stock, the inadequacy of the farm-buildings, and the small size of the enclosures which here prevail. He would find the land cleared of its sheep after the consumption of the swede and root-crop, the hay and straw very generally sold, and barely replaced by London manure, when it is to be had. Very many exceptions may of course be found, among which a farm at Wheathampstead, near the centre of the district under consideration, is a notable instance.

#### SHEEP FARM AT WHEATHAMPSTEAD.

The farm consists of 317 acres, of which 20 are in not very productive grass-land. Fifty-six acres of the arable are upon the strong loam of the higher levels, and the remainder is of a lighter

SECTION FROM SURVEY OF THE RIDGE MIDWAY BETWEEN THE GADE AND VER, WITH THE DEPTH AT WHICH

WATER IS FOUND IN THE CHALK.



SCALF.

Vertical . . . 200 feet to Inch.

Horizontal . . 2 Miles to Inch.

character—rather a sharp flint-gravel, somewhat under the average quality of the district. The whole has been more or less chalked from below, according to the custom of this county. The fertility of the farm is maintained, not by selling off the produce and trusting to London and other extraneous sources for an equivalent, but by developing and trusting to its own internal resources. The following list of animals fattened and sold from the farm has been kindly furnished in illustration of the system pursued:—

						1862.		1863.
Lambs	..	..	..	..	..	391	.. ..	392
Sheep	..	..	..	..	..	333	.. ..	356
Beasts	..	..	..	..	..	6	.. ..	5
Calves	..	..	..	..	..	45	.. ..	50
Pigs	..	..	..	..	..	205	.. ..	198
Total head						980		1001
On 317 acres of land.								

The system of cropping is four-course, managed with especial reference to sheep-stock. Much reliance is placed on the deep cultivation of the soil, which is principally effected by the use of a two-wheeled plough, divested of its mould-board, which follows the first plough, armed with a share copied from that of the unwieldy and disused old Hertfordshire plough. Besides the usual succession crops of swedes, mangold, mixed layers, tares (to be followed by white turnips), it is the practice here to sow rape between the rows of beans on the heavier portion of the farm.

A certain portion of the ewe flock, which averages 330 head, consists of Dorsets, which are put to a Sussex or half-bred ram; both ewe and lamb are generally fattened for sale, and the stock replenished from fairs.

#### THE CHALK DISTRICT.

The Northern or chalk district, having a fall anticlinal to the dip of the stratum, is drained by streamlets which are the affluents of the Cam, the Ouse, and, in one instance, of the Thames.

This remarkable tract of land may be surveyed looking from Sandon, which stands high on a rounded escarpment of the outlying Plastic clay.

On descending from the higher ground, the chalk—here geologically the lower chalk without flints—is more thinly covered with gravel, and very frequently becomes a part of the cultivated tilth. It does not, as in the Vales of Aylesbury and White Horse, end in bold escarpments immediately overhanging the upper green sand and gault, but sinks to the level of these strata



by gentler undulations, which present a breadth of very useful arable land. This district is thus described by Sir Henry Chauncy in the 'Historical Antiquities of Hertfordshire' (1700) He says, "The Vale of Ringtale, or Wringtale, which lies north of the great ledge of hills crossing the northern part of this county (extending from Backway to Offley), where the soil is mixed with white marl, yields the choicest wheat and barley, such as makes the best malt that serves the King's Court or the City of London, which caused Queen Elizabeth often to boast of her Hitchin grape."

It has been noticed that this county comprehends within its boundary a small tract of land to the north of the villages of Ashwell and Caldicot, on the outcrop of the trace of the greensand and of the gault clay which underlies the lower chalk. It is all more or less covered by the drift of the chalk, though in some places the sheer gault lies very near the surface. Though its general features and management resemble those of the tract to the south just described, which rests on the lower chalk, there is this notable difference—that, as it rests on a clay subsoil, it requires thorough drainage. It was here that Mr. Bailey Denton carried out that mixed system of drainage of which there is so full and valuable a record in this Journal under the head of the Hinxworth Drainage.

#### IRRIGATION, MILLS, AND MEADOWS.

Although the streams which issue from the deep valleys by which the surface of the chalk is furrowed afford to this county abundant supplies of water, agriculturally they have not been turned to much account.

Near Rickmansworth, on the Chess, on the Bean, and at the Hoo, water-meadows indeed may be seen; but frequently the ancient weirs have been superseded by mills, the old water-rights having been either bought up by the millowner or lost by desuetude. The corn-mills themselves have often been diverted to the manufacture of paper, for which purpose machinery was first set up by M. Foudriener, its inventor, on the river Gade.

The Gade, as it traverses this county, has a uniform fall of 14 feet per mile, which offers great natural facilities for irrigation, as well as water-power.

#### DRAINAGE OF LOW MEADOWS.

Perhaps there is nothing in the whole county which more obviously calls for improvement than the so-called water-meadows, or rather marshy swamps, which line the banks of some of the rivers. This is more striking in districts where there is little

natural or available grass-land. The remedy is simple. The mill-dams are impediments to the free action of the landowners, but very generally this difficulty may be overcome. The wetness of the meadows is not, even near the mill-heads, due to soakage from the river, but from stagnation in the soil of water derived from springs on either side of the valleys. As a remedy, first a ditch should be cut as near to the side of the valley and as far from the river as possible. In some cases pipes of large bore might be used; the spring-water should then be led below the outfall provided by the next mill-dam; the cleansing of the ditches, brick-rubbish, or any hard material, should be placed or even piled on the surface of the meadows; then with ordinary attention to keeping up the river-banks and filling up all transverse ditches, much valuable land might be reclaimed from its virtual sterility.

#### WATER-CRESSES.

A new rival to the water-meadow has sprung up of late from the artificial culture of water-cresses. Fifty years ago those who sold this plant were content "to strip the brook with mantling cresses spread." One such was Mr. Bradbury, to whom the idea suggested itself that water-cresses might be cultivated to advantage. He obtained permission first to try the experiment in spring-ditches at West Hyde, in the parish of Rickmansworth, just on the borders of Bucks, and satisfied the occupier of the land that the cleansing of the ditches and regulation of the height of the water in them as practised by Mr. Bradbury was beneficial. The ditches were next let at a certain rent and under certain restrictions, and very shortly Bradbury's cultivated water-cresses became a regular article of traffic in the London market. From this small beginning a large trade has sprung up, which now extends to the Manufacturing Districts. The persons who hire the spring-ditches for the cultivation of the plant scour and cleanse them with much care, level their bottoms, and often expand their area till they form a series of shallow lakes, in which the height of the water is regulated by dams. These dams are either permanent—formed of stones or two lines of boards, supported by stakes, between which clay is rammed; or temporary—consisting of moveable boards, bricks, or other materials. These, in some cases, are either placed transversely to the flow of the water, to keep it to its required level in the subdivisions of the beds, or else so arranged that the stream may be conducted under the bank-side, apart from the adjacent bed, as by an irrigation-carrier, to any spot below. Very frequently borings are made in the chalk to facilitate the issue of the clear spring-water in its purity, which is deemed of great

importance to the quality of the crop. The best sorts of cresses are then selected, that most in request is known as the Dutch Brown, from the shade of colour it takes when it has reached maturity. The plants are placed in rows, generally with stones upon them, to prevent their being removed by the flow of the water. All this is done at considerable expense; besides which it is necessary to guard the beds from attacks of birds, especially the blackbird, whose ravages at certain seasons are of a very serious character. By regulating the height of the water in the various divisions a proper succession in the ripening of the crop is secured. The cutting is performed either by wading in waterproof boots between the rows, or by placing moveable planks across the beds. The washing and packing in hampers or baskets finishes the operation. The growth of this simple and indigenous plant is daily on the increase; the letting the ditches for this purpose is more profitable to the landowner than the irrigation of the meadows, if it could be done; the rent cannot be estimated by the acreage under cultivation. Such sums as 40*l.*, 50*l.*, and upwards are often paid by persons who have little capital but their industry, and employ a great proportionate amount of other labour in gaining their living.

#### CHERRY-ORCHARDS.

In the western parts of the county the cherry-orchards occupy so considerable a portion of the soil, and form so great an item in the rural economy, as to demand attention. They are generally found at a high elevation, where there is a considerable depth of loam, clay, or gravel, naturally drained by the chalk beneath. The great age of many of the trees shows that their culture is of ancient date, as also appears from the agricultural histories of Hertfordshire. It does not seem that these orchards have been extended of late years, in spite of the access to the Manufacturing Districts afforded by the introduction of railways. The great drawback to the cultivation is the precarious nature of the crop, which is very often destroyed in a single night by an untimely frost, apart from other casualties to which fruit-crops are liable. The fruit is generally sold on the trees to dealers, and realises from 12*s.* to 16*s.* per "ped" or basket, holding about four dozen pounds. The sorts grown, though not confined to the county, are characteristic of Hertfordshire. These are known as the Caroon, the largest sort, and small Hertfordshire black. Besides the usual uses, they are converted into cherry brandy, and, if report says true, enter very largely into the composition of other liquors, to which they do not give their name. They are also used for the purpose of dyeing.

## WOODS AND PLANTATIONS.

Woodlands cover a large part of the surface of this county. The quantity and quality of timber varies considerably in different districts. In the north-western portion, where the chalk is near the surface, beech woods prevail. To the south of this, on a zone running from the south-west to north-east, oak and ash are more abundant, both in the woods and on hedge rows, the oak having generally a stunted appearance; the ash is also of slow growth, but bears a good character for wheeler's stuff. Still further south the elm may be said to be the weed of the country. In the most southern portion, where the chalk is covered by the London and Plastic clays, the elm and oak attain a much larger growth, unless the upper drift gravel intervene, which is only suited to larch or fir. The beech woods, in which underwood refuses to grow, are periodically thinned, and the fall used by wheelers, and, in some cases, by chair-makers, though this trade is almost entirely confined to Buckinghamshire. The ordinary coppice is commonly cut every twelve years and sold by auction. As a general rule, the growth is not sufficiently straight and free to serve a better purpose than making rods or headers for fencing, pea-sticks, faggots, or at best, turner's stuff, or sparred hurdles and wattled hurdles for sheep.

The woodlands are too often objects of little care, and are scarcely ever renewed or replanted as the old stools die or fail. Those which belonged to the late Sir John Selbrite, of Beechwood, are, however, an exception to this rule, and bear the traces of careful replenishing to this day; his son and successor follows his example.

In many places woods have of late been grubbed, when, from their frequent interlacing with the arable land, they were incompatible with improved cultivation; but in a county where there are so many resident proprietors, coverts for game will not readily give place to the steam plough.

## STRAW-PLAIT.

The manufacture of straw-plait not only furnishes employment for the females of the labouring classes, but bears on the agricultural interests of part of the county, by creating a market for some of the wheat-straw grown within its limits. This trade, from its nature, varies with and is ruled by the fashions in dress. Luton and Dunstable, in Bedfordshire, are its headquarters, though it extends to the centre of the county of Hertford, where much plait is made to supply the dealers, whose attendance at Hitchin and elsewhere creates a considerable market. The



straw grown on the chalk soils at the north of the county is well fitted for the purpose. The straw drawers either purchase the straw in the bulk, and take away all that suits their purpose, or, more commonly, bargain to take, by weight, that only which they select. The farmer who has a crop fitted for the purpose has it reaped with great care, if the weather be fine, in an early stage of its maturity, leaving the sheaves open for a time till they are quite dry, and setting aside those in which the straw may be twisted; they are then placed, with care, in the rick or mow, so as to come out quite straight and uninjured. The person who is employed by the dealer to draw the straw takes a certain quantity from the sheaf and binds it quite tight with a leathern strap; he then places his parcel, thus formed, between his legs, takes a few straws at a time just beneath the ears and draws them out, until his other hand, to which he transfers them, is full, and ties the handful, like a gleaner, beneath the ears. The flag is removed by a coarse iron-toothed comb, the ears are cut off, and it is then handed to a second person, who makes up bundles about a foot in diameter, neatly bound with straw. The straw is then in a marketable state, and passes to the manufacturer to be sorted, cut into lengths, and so fitted for use. The waste is not so great as might be supposed, all the chaff and caving is left behind with the ears, and with much of the rough straw, which may be converted into manure. The operation puts the farmer to some inconvenience, but the price given is remunerative, amounting, on an average, to about a penny per pound, so that the value of the straw may exceed that of the corn.

The moral effects of this manufacture are often called in question; the early age at which the children are employed sadly hinders their education by keeping them from the village school; it indisposes and unfits them for domestic service, though it retains them at home and hinders their being subjected to the drudgery of field labour.

#### VARIETIES OF WHEAT.

Although the vale of Ringdale, in the north of the county, gained a name of old for the Hertfordshire white flour, the land generally is better adapted to the coarser red wheats, and high farming cannot in this respect overrule the inherent quality of the soil.

To Mr. Hainworth, of Hitchin, great credit is due for the attention bestowed by him on the selection and improvement of wheats. He is a cultivator of Spalding, Syer's Red, Red Straw White, Hopetown White, Red Lammas, and other wheats; and has given his own name to a variety raised by him from a

single ear, which he specially recommends, as bearing the forcing of high farming.

As the fair testing of different sorts of wheat on the same ground is as difficult as it is important, Mr. Hainworth's method is worthy of notice. First he selects a field in which the soil is as near as may be, of an uniform character, measuring, for example, 16 poles wide by 33 poles long; 8 rows of each different sort of wheat are dibbled with great care, the short way of the land, 9 inches apart, and 5 inches between the holes, in each of which three corns are deposited. This is repeated in succession until the whole piece of land is cropped with say 11 beds of each sort. The 8 rows of each variety in each bed are reaped separately, bound and set up, then brought together, threshed and measured, thus giving a fair average of the whole 11 beds, grown in different parts of the same field. The farm on which these experiments are made is necessarily in a high and cleanly state of cultivation; its fertility, in fact, is maintained by the application of London stable manure. If this careful selection, cultivation, and testing of varieties of wheat be looked on merely as a commercial speculation, the results must be valuable; but in this case, as in almost all such, the higher object of advancing the interests of agriculture gives a fresh stimulus to the labour and skill which such experiments at all times require.

### SHEEP.

After a word of commendation of the Hoo flock of 400 Sussex downs, improved of late by rams from Babraham, and a word of warning as to the ultimate results of cross-breeding between the long and short woolled races, however promising at first, I pass on to speak of that which for not less than two centuries has been called "the far-famed Bennington flock." Bennington is a village near the centre of the county, between Stevenage and Standon. The flock, which is still owned by the descendants of those who first formed it, is said to have sprung originally from the old Wiltshire horned breed, which appears to have formed the staple of the sheep stock in the midland counties of England up to the beginning of the present century. Within the memory of many persons, the horn, one of its distinguishing features, though reduced in size, was still retained, and in all respects the sheep were nearer their original type than at present. Attempts at improvements were at one time made by the introduction of Leicester, Gloucester, or Cotswold rams, though the produce of one, if not both these crosses, was weeded from the flock. Of late years the chief, if not the only new blood, has been Lincoln; some of the flock still retain traces of

the Roman nose, and other traits which render this flock remarkable, both as a record of the past, and a most interesting instance of the successful breeding of long woolled sheep. It is said, and the assertion is borne out by the appearance, great size, and noble character of the flock, that the weight to which the ewes attain when fatted is 20 stone, that a teg has been known to shear  $21\frac{3}{4}$  lb. of wool; and that the average weight of two fleeces is 28 lb., or 1 tod. The flock now unfortunately numbers only 200. The value placed on them for breeding purposes may be learned by the significant fact, that all the ram lambs are saved, and command a ready sale at good prices.

It may be a question whether this breed and quality of sheep is that best fitted to a neighbourhood and soil such as that on which it has been so long and so successfully maintained; the mere fact of its existence, however, supplies an argument in its favour. They are said to do better and to be more hardy than the Lincolns, by which, from time to time, the stock has been replenished, and compared this year favourably with some Lincolns newly imported, which stood beside them in the fold.

#### IMPLEMENTS.

One novelty among implements is to be found in the adjustment of shafts for the purpose of turning, or rather reversing the action of a heavy iron roller, an unpatented invention of the owner of Beechwood, which weighs 3 tons, and can be loaded by filling a cradle with stones up to 4 tons. The roller is used either on the sward of the park, or to compress the roads; in either case, the difficulty is to turn so heavy an implement with two horses drawing abreast, and necessarily leaning on a shaft. This is avoided by fitting the double shaft to the upper of two hollow discs of woodwork encircling the cylinder, which revolves after the manner of a railway turn-table on that beneath it. For the purpose of turning, two vertical iron pins, by which the discs are fastened together, are drawn, the horses make a half turn, the pins are replaced, and the roller is ready to move in the opposite direction, without the least strain or inconvenience to the team.

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XIV.—*Agricultural Notes on the Census of 1861.*

By J. D. DENT, M.P.

MY DEAR SIR,—In looking over the Reports of the Census Commissioners for 1861, I have met with certain information connected with Agriculture, which, I think, deserves some permanent record in our Journal; and I shall venture to submit to you, first, some of the Tables which have been prepared by the Commissioners, and then a few remarks of my own upon them.

The first thing which strikes us, in England and Wales, is the aggregation of population in towns—the inhabitants of 781 towns amounting to 10,960,998; and those of the villages and country parishes to 9,105,226. “The area occupied by the 781 towns is 2991 square miles; that of the rest of the country, 55,330 square miles.”

During the decennial period from 1851 to 1861 the rate of increase of population has been much greater in town than in country, and the large towns have gained more than the small ones. In 1851, 580 towns were included in the record, and in that year the population of these towns and that of the surrounding country was nearly equal; “but in the subsequent ten years, while the population in the villages and country parishes increased at the rate of 6·5 per cent., the increase in the towns was 17·3 per cent., this difference being due to the migration from country to town.”

Unfortunately, for purposes of comparison, the Census Commissioners of 1861 have drawn up their Tables which refer to the occupations of the people, in a somewhat different form from those of 1851; and there is also a variation between the Scotch and English systems, which renders an exact comparison a matter of difficulty. These changes have arisen from a desire to impart to the returns of each successive census a greater degree of accuracy, and to point out more clearly the different occupations of the people. In 1851, and again in 1861, the farmers of the United Kingdom were requested to return the number of acres which they occupied, and also the number of labourers whom they employed. In 1851 we find 91,698 persons, who, in the returns, called themselves farmers, but had apparently no labourers. Many of these probably did all the labour themselves; others had the assistance of their children; some employed labourers only during a portion of the year; and some may have had labourers whom they did not return. It is certain, however, that in parts of the country, men who have only a few acres of land and employ no workmen, have always been returned as farmers; and this we must bear in mind when we compare the number



of farmers and graziers as stated in the Occupation Tables with the number of farm-holdings returned. There is considerable uncertainty as to whether the farmers returned all their in-door farm-servants; and while in some cases women and boys were included, in others they were not. We must also bear in mind that many of the labourers, and also of the farmers who are here returned, are disabled or superannuated; the workman as well as the retired tradesman or professional man being, by the rule of the Commissioners, referred to his former calling, even though he might be an ineffective member.

The first Tables which we will extract are VII. and VIII.:—

TABLE VII.—NUMBER of Persons engaged in AGRICULTURE in ENGLAND and WALES, enumerated at each of the Censuses of 1851 and 1861.

Occupations.	Persons.		Males.		Females.	
	1851.	1861.	1851.	1861.	1851.	1861.
Total of Agricultural Order . . .	2,011,447	1,924,110	1,559,762	1,545,067	451,685	378,443
Land Proprietor . . . . .	30,315	30,766	17,047	15,131	13,268	15,635
Farmer Grazier . . . . .	249,431	249,735	226,515	226,957	22,916	22,778
Farmer Grazier's Wife . . . . .	164,618	163,765			164,618	163,765
Farmer's Son, Grandson, Brother, &c.	111,704	92,321	111,704	92,321		
Farmer's Daughter, Sister, Niece, &c.	105,147	83,830			105,147	83,830
Farm-Bailiff . . . . .	10,561	15,698	10,561	15,698		
Agricultural Labourer (Out-door) .	952,997	938,265	908,678	914,301	44,319	43,964
Shepherd (Out-door) . . . . .	12,517	25,559	12,517	25,559		
Farm-Servant (In-door) . . . . .	288,272	204,962	189,116	158,301	99,156	46,561
Land Surveyor, Land Agent . . .	3,064	4,702	3,064	4,702		
Agricultural Student . . . . .	104	490	104	490		
Hop-Grower . . . . .	30	33	30	33		
Willow Rod Grower or Dealer . . .	60	35	59	35	1	
Teazel Grower, Merchant . . . .	85	81	85	81		
Agricultural Implement Proprietor	55	236	50	236	5	
Agricultural Engine and Machine } Worker . . . . .	..	1,205	..	1,205	..	..
Land-Drainage Service . . . . .	11	1,761	11	1,761	..	..

The remainder of the list of occupations is not so closely connected with agriculture:—

Occupations.	Persons.		Males.		Females.	
	1851.	1861.	1851.	1861.	1851.	1861.
Colonial Planter and Farmer . . .	16	91	16	91	..	..
Others connected with Agriculture	128	117	116	73	12	44
Woodman and Wood-gatherer . . .	7,772	8,916	7,772	8,907	..	9
Others connected with Arboriculture	236	10	220	10	16	..
Gardener . . . . .	71,805	78,533	69,685	76,760	2,120	1,773
Nurseryman . . . . .	2,333	2,917	2,350	2,838	33	79
Watercress Grower . . . . .	39	55	39	55	..	..
Others connected with Horticulture	97	27	23	22	74	5

TABLE VIII.—NUMBER of Farmers and Graziers, Farm-Bailiffs, Farm-Servants (In-door), Agricultural Labourers, and Shepherds (Out-door), enumerated at the Censuses of 1851 and 1861 in England and Wales.

1851 .. .. . 1,347,387  
1861 .. .. . 1,340,916

In Scotland, the totals of the agricultural class were—

1851 .. .. .	388,203
1861 .. .. .	378,609

These Tables may be found at p. 35 of the 3rd vol. of the 'Census of England and Wales for 1861.'

From Table VII., I think, we may gather that the tendency in England and Wales is not towards a subdivision of land. The class who return themselves as proprietors of land, remains very stationary; and from my own experience, I should say that land is not going into more hands, but that estates are rather increasing in size; and that landed proprietors, as a class, are a wealthier body than they formerly were.

Tables, which I shall shortly quote, will give us the idea that the size of farms is increasing, and that small holdings are being absorbed in the larger; and this is to some extent corroborated by Table VII., in which we find fewer of the farmers' relatives employed upon the farm, and farm-bailiffs considerably increased. The very great diminution of in-door male farm-servants is a further indication of a change in the class of men who now make farming their pursuit; since men of the new stamp feel the inconvenience of boarding in their houses a large number of youths, with whom, a few years ago, the farmer worked during the day, and associated in his leisure time.

But the increase in male out-door labourers and shepherds does not compensate for the decrease in in-door servants, which, exclusive of the farmers' relatives, amounts to 12,050. I am not inclined, from personal experience, to imagine that there has been any decrease in the aggregate of manual labour employed upon farms; on the contrary, the superior cultivation of our crops, and the increased care bestowed upon our flocks and herds, lead to the opposite conclusion. When, therefore, I remember that some few years ago it was no unusual thing in a parish of 600 inhabitants, not far removed from an active manufacturing district, to have ten or a dozen labourers entirely or partially out of work during the winter months, and that now in the same parish we are frequently obliged to supplement our own labourers by Irish, I can only conclude that the redundant agricultural population has been absorbed by manufacturing industry; and that those who remain are more efficient, better paid, and more fully employed than they were 10 years ago. Referring to Table VII., it will be found that three new classes of industry have been called out to assist in agriculture. There are now 236 proprietors of agricultural machines, which, being no doubt let out for hire, are available for the small farmer; and attached to these there are 1205 agricultural machine-workers. Besides these, the land-

drainage service forms a new class of 1761 men, who are principally employed by the companies which lend money for agricultural improvements.

We find the class of out-door shepherds more than doubled since 1851, rising from 12,517 in that year to 25,559 in 1861. This increase of shepherds does not seem to agree with the conclusion, at which Mr. Thompson arrived in the last number of the *Journal*, viz., that our sheep-stock had diminished. During the show-week at Newcastle I had the opportunity of talking this matter over with Messrs. Torr and Randell, who attributed the increase in the shepherd-class to two causes; first, to the increase of sheep, which each of them, speaking the one of Lincolnshire, the other of Gloucestershire, believed to have been considerable; and, secondly, to the enlarged size of farms. On small holdings, the farmer, his son, or his head man looked after the sheep, and was not returned as a shepherd: as farms grow larger, and the flocks on them are increased in number, it becomes the sole duty of one or more men to look after the sheep, and this is another reason why the class returned as shepherds has so largely increased. The experience of these two gentlemen is so much more valuable than my own that I readily quote it, and will merely add, that it quite coincides with what I have noticed in my own locality.

Yet another class may, for a moment, claim our attention. In 1861, 490 agricultural students are returned as against 104 in 1851—another indication of the new race of farmers, who find it advisable to exercise their brains as well as their muscles in the service of agriculture.

Another set of Tables is published which are of some interest as far as they go, because they profess to give the size of the farm-holdings in this country. In 1851, these were worked out for the whole country; but in the census of 1861, the abstracts were on a smaller scale, because the Commissioners had a delusive hope that such returns might be superseded by a general system of Agricultural Statistics to be carried out for England and Wales on the Irish plan. In this year, therefore, they selected one county from each of the the ten registration districts into which England and Wales is divided, and made the abstracts for those counties only. The counties selected were Buckingham, Cambridge, Chester, Cumberland, Lincoln, Norfolk, Shropshire, Sussex, Wiltshire, and the North Riding of York.

There are, however, three Tables of the year 1851 which relate to the size of holdings generally in Great Britain; and as there are no corresponding Tables in the Report of 1861, I will quote them here.

The following Table in the Census of 1851 gives the number of acres of cultivated land in Great Britain; but the hill-pastures of

Scotland, and probably of some parts of England and Wales are not returned as cultivated :—

ACRES of LAND in GREAT BRITAIN, and Acres of Land returned as in the Occupation of the Farmer by whom it is Farmed.

	Number of Farms.	Acres of Territory.	Estimated Number of Acres under Culture as returned by Farmers.	Number of Acres Uncultivated or Unaccounted for.
Great Britain .. ..	285,936	57,624,377	29,213,312	28,411,065
England .. .. .	225,318	37,324,915	24,905,758	12,419,157
Scotland .. .. .	56,650	20,047,462	4,188,578	15,858,884
Islands in the British Seas .. .. .	3,968	252,000	118,976	133,024

The following Table represents the average size of farms in Great Britain at the same date :—

Acres.	NUMBER OF FARMS.			
	Great Britain.	England and Wales.	Scotland.	Islands.
Total .. .. .	283,378	223,271	56,150	3,957
Under .. .. . 100	190,573	142,358	44,469	3,746
Between 100 and 200	52,912	45,752	7,009	151
200 and 300	20,603	18,401	2,166	36
300 and 400	9,031	8,061	961	9
400 and 500	4,063	3,585	471	7
500 and 600	2,248	1,971	272	5
600 and 1000	2,816	2,372	442	2
1000 and upwards	1,132	771	360	1

The size of 2558 farms in Great Britain—of 2047 in England and Wales, of 500 in Scotland, and 11 farms in the islands of the British seas—was not stated.

In the same year, the proportional number of farm-holdings of various sizes was given. Out of every thousand farms there were :—

Acres.	Great Britain.	England and Wales.	Scotland.	Islands.
Under 100	672·50	637·60	791·97	946·68
100	186·72	204·92	124·83	38·16
200	72·71	82·42	38·58	9·10
300	31·87	36·10	17·11	2·27
400	14·34	16·06	8·39	1·77
600	9·94	10·62	7·87	·51
1000 and upwards ..	3·99	3·45	6·41	·25

Had similar Tables to the foregoing been prepared for 1861, we might have made a more accurate comparison for the whole of



England and Wales, than the Tables for the ten selected counties, to which I shall now refer, will enable us to form :—

TABLE 100, page 144, vol. iii., GENERAL CENSUS REPORT, 1861.

Numbers and Proportions of Farm-Holdings of various Sizes in the Counties of Bucks, Cambridge, Norfolk, Shropshire, Lincoln, Wilts, Sussex, Cheshire, Cumberland, and North Riding of Yorkshire, as returned at the Censuses of 1851 and 1861.

Size of Farm-Holdings in Acres.	Number of Farm-Holdings.		Of every 1000 Farm-Holdings, the proportional number of the size represented in the First Column.	
	1851.	1861.	1851.	1861.
Total .. .. .	52,552	46,526	1000·00	1000·00
Under 100	31,583	26,567	600·99	571·00
100	11,035	10,022	209·98	215·41
200	4,869	4,666	92·65	100·29
300	2,153	2,285	40·97	49·11
400	1,060	1,096	20·17	23·56
500	648	640	12·33	13·76
600	881	942	16·76	20·25
1000 and upwards	323	308	6·15	6·62

*Note.*—The above numbers exclude 416 farms in 1851, and 665 in 1861, from which no returns of acreage were received.

TABLE of the Number of HOLDINGS of LAND in the Ten Counties of Bucks, Cambridge, Norfolk, Shropshire, Lincoln, Wilts, Sussex, Cheshire, Cumberland, and North Riding of Yorkshire, in 1861 and 1851, with the Increase or Decrease of such Holdings.\*

Size in Acres.	1861.	1851.	Decrease.	Increase.
Under .. .. . 5	1086	1784	698	..
Between .. .. 5 and 10	2656	3590	934	..
10 and 20	4676	5603	927	..
20 and 30	3434	3967	533	..
30 and 40	2955	3298	343	..
40 and 50	2621	2897	276	..
50 and 75	5609	6344	735	..
75 and 100	3530	4100	570	..
100 and 150	6205	6942	637	..
150 and 200	3817	4093	276	..
200 and 250	2915	3110	195	..
250 and 300	1751	1759	8	..
300 and 400	2285	2153	..	132
400 and 500	1096	1060	..	36
500 and 600	640	648	8	..
600 and 800	645	605	..	40
800 and 1000	297	276	..	21
1000 and 1200	147	157	10	..
1200 and 1500	90	82	..	8
1500 and upwards	71	84	13	..
No return of acreage .. .. .	665	416	..	249

\* This Table is calculated from two Tables, No. 87, 88, which may be found at page 139, vol. iii., of the General Census Report of England and Wales, 1861.

This decrease of small holdings agrees very much with the conclusions which we drew from the Tables of the occupation of the people, that slowly, but steadily, the tendency is for large farms to absorb the small ones. Indeed, the change that is coming over modern agriculture will fully account for this. Men who freely embark their capital in the cultivation of the soil are anxious to have a wide field for their operations. As the increased production of forage-crops, together with the large purchase of corn and cake for feeding purposes, requires improved buildings for the accommodation of stock, the landlord perceives that a considerable outlay on his part must be necessary; and he naturally is constrained to have his farms increased and consolidated that this outlay may be remunerative, and as little burdensome as possible.

Even though the decrease of small holdings is proceeding upon rather an extensive scale, if we are to take the ten counties as a general index of the state of the country, nevertheless the great proportion of land in England is still so held.

Referring to Table 100, we find in these counties that 571 out of every 1000 holdings are under 100 acres; 215·4 are between 100 and 200; and 100·29 between 200 and 300; leaving out of every 1000 farms but 113·30 which are 300 acres and upwards. Whilst I find that, of farms more than 500 acres, there are but about 31 in every 1000 in Cambridgeshire and Lincolnshire, 49 in Norfolk, 46 in Sussex, 93 in Wiltshire, 14 in Cumberland, 15 in Bucks, and 8 in the North Riding; and in Cheshire and Shropshire they scarcely exist.\*

I am not much surprised to find that the farms which vary from 50 to 200 acres are being absorbed, because they were generally occupied by men of small capital, who were very much dependent upon corn crops for their living, and, at the present prices of grain, such men, not having stock to back them up, cannot make farming remunerative; but I am rather surprised at the very great decrease of holdings of the smaller size, up to 20 acres. The great demand there is for such occupations, not merely by the industrious labourer but by the rural tradesmen and artisans, would have made me imagine that the decrease might not have been so rapid; and I feel inclined to regret the fact that no less than 1632 small holdings under 10 acres have disappeared, for I should fear it is a sign that fewer agricultural labourers have their paddock and their cow than was the case ten years ago. In my own neighbourhood I know how eagerly the small cow-paddocks are taken, and how valuable is the milk to the family; and I have seen so much good in many cases arise

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\* These figures are calculated from Tables 89 to 98, pp. 140 to 143, vol. iii. Census Report.

from this addition to a man's position, that I should regret to think it not so easily attained as heretofore. That the number of small holdings is to some extent a test of the labourer's prosperity is, I think, shown by the fact that the proportion of small holdings in Lincolnshire, where labour is high, and also in Cheshire, Cambridgeshire, and Norfolk, varies from 28 per cent. in Cheshire to 19 per cent. in Norfolk; whilst in Wiltshire, Cumberland, and Bucks, the per centage drops to 12, 10, and 8. Now, the last Parliamentary return on agricultural wages in the year 1860 is less complete than it well might be. There is no return, for instance, from Bucks at all. In Cumberland there are returns from three unions, in which employment is described as uncertain, though at particular seasons men make good wages; whilst in Wiltshire from 9s. to 10s. per week is returned as the average, with 20s. to 25s. in harvest time; in Cheshire the returns for the agricultural labourer are at 11s. to 12s. per week; but we must remember that we get many operatives and a much higher paid class in some parts of that county; in Lincolnshire 13s. 6d. to 15s. are the returns; in Cambridgeshire, for only one union, regular work 10s. to 12s., and 14s. to 16s. at task-work; and the return from Norfolk is to the same effect.

This survey of our present position suggests the inquiry whether the increase of our towns and of railways may not have had something to do with the changes that are taking place? The 781 towns in England and Wales, which are enumerated in the Census, include an area defined by the municipal or parliamentary boundary, or that of some local or district board, of 2,991 square miles, or nearly two million of acres. Of course this space is not all covered by buildings, but a very large proportion of it is either used for purposes of building or of recreation, and is not productive of human food. Again, there were at the close of 1860, 7583 miles of railway open in England and Wales, which may be roughly estimated to occupy 83,413 acres of land; and the quantity so occupied is increasing every year.

This brief examination of the Census papers only leads us to regret that there is not more accurate information to be obtained as to our agricultural position. No one doubts that a great increase of energy and capital is now devoted to farming operations, and yet it is impossible to measure the extent of our agricultural progress. Rents are higher, the price of land is higher, and farms are in greater demand than ever; unless, therefore, the increase of our crops and of our stock is considerable, it is not easy to see how farming can be remunerative. But we have no means of testing this. Some persons are of opinion that a good deal of land is being laid down to grass; but I think this un-

certain—I do not myself see many signs of it. We know that in Ireland during the late disastrous years a certain portion of land has gone out of tillage, and between 1862 and 1863 the Bog and Waste *unoccupied* has increased by 74,856 acres, owing to the withdrawal of live stock from the mountain and boggy pastures, consequent on the decrease in Irish cattle, which since 1859 has considerably exceeded the whole of our importations of foreign cattle. But the stock in Great Britain is still an unknown quantity, and the only Returns of the produce of our crops, being those made by the corndealers, are notoriously imperfect. These Returns, which are given to us in the statistical abstracts annually presented to Parliament, by no means lead to the conclusion that any considerable increase has taken place in the growth of wheat or barley, while they point to a decided decrease in oats:—

QUANTITIES of WHEAT, BARLEY, and OATS sold in the principal Market-towns in England and Wales from 1851 to 1863.

Years.	Wheat.	Barley.	Oats.
1851	4,487,041	2,333,710	940,006
1852	4,854,513	2,389,489	947,550
1853	4,560,912	2,474,206	880,408
1854	3,913,257	2,267,997	765,438
1855	5,256,874	2,608,862	816,688
1856	5,046,736	2,678,936	701,159
1857	5,243,940	2,262,733	537,364
1858	5,203,948	2,434,373	482,766
1859	5,498,202	2,410,326	503,256
1860	4,623,257	1,787,056	495,880
1861	4,289,665	2,392,872	624,898
1862	3,588,085	2,281,930	702,957
1863	4,493,471	2,487,660	571,086

Now, if we refer to Mr. Lawes' paper on 'Experiments on the Growth of Wheat for Twenty Years in Succession on the same Land,' published in the last number of the Journal, we shall find the variations in the preceding Table agree very closely with his sketch of the different seasons. The harvest of 1854 was one of the largest in yield for many years past: that of 1855 less abundant than that of 1854, and various in quality; in 1856 the quantity of land under wheat was considerably over the average, the crop was more than an average, but not well got in; in 1857 the extent not so great, but the crop unusually productive; and in 1858 a crop clearly above the average, though not so great as in 1857. We then come to the unfavourable seasons of the last few years; and on the whole this return does not indicate that our production of corn is increasing to any very appreciable extent. Mr. Thompson, in his very able paper in the last Journal, holds



rather a different opinion as to our production of corn; but with respect to our stock, he comes to the somewhat startling conclusion that sheep have actually diminished in number; a diminution which the Irish returns unfortunately confirm, both as to cattle and sheep, as far as that country is concerned.

The existence of these doubts, and the consciousness that great changes in agriculture are in silent operation, of which we cannot measure the extent, tend to make us desire trustworthy, and therefore systematic, information on such questions as we have here suggested, which are of so much interest alike to the consumer and producer.

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XV.—*The Management of a Suburban Farm.* By J. BLIGH  
MONCK.

PRIZE ESSAY.\*

MANY persons who are led by the social and other advantages of town life to give it the preference, nevertheless acknowledge the superior beauty, healthiness, and other attractions of the country. The bright corn fields, the orderly array of luxuriant "bracts," the cheery faces of the rural population, the readiness with which a bountiful nature perfects the work of the husbandman, hold out to them a very tempting prospect. But what if the enjoyments of either way of life can be combined by the occupation of a farm close to a town! What position can be so desirable, presenting such ready opportunities for selling on the spot the more bulky and perishable articles of your production, and again of procuring close at hand the refuse which your customers are anxious to be rid of?

As I find many practical farmers hold this opinion, and the generous offer of a prize for the best description of suburban farming, almost implies that some special management is essential to success near towns, I venture to offer the result of twenty-five years' experience on a gravelly soil liable to burn, in the immediate vicinity of a borough of upwards of 20,000 inhabitants. I shall have to consider the advantages attendant on such a situation with its accompanying drawbacks, that I may assist owners and occupiers of land under the like circumstances, in turning the one to the best account, and in making light of the other.

But first it will be well for me to explain what I mean by a farm, and by farming profitably. It is well known that in the

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\* This Prize was placed at the disposal of the Society by Sir Compton Domville, Bart.

immediate neighbourhood of every town small portions of land can be let for large annual rents, from four to five pounds per acre higher than those paid for the same class and quality of land some seven or eight miles further off. These rents are given gladly by gentlemen for the purpose of keeping their cow or pair of horses; by butchers for a lair for their stock till the killing day; by nurserymen and market-gardeners, and many others, who use the land merely as a part of the premises necessary to carry on their retail trade. Of these the market-gardener makes the nearest approach to being a farmer, but differs from him in that he makes his profit (and consequently his rent) not by the production of the crops he grows, but by their retail delivery—of which more hereafter. I shall exclude these, as also cattle-dealers and small milkmen, who keep a cow or two for the supply of the shop, or to carry round milk, &c., to their customers, for the same reason; reckoning as farmers those only who make a living by the land they cultivate, and get a sufficient return from it to live as farmers—employers of labour, not labourers themselves. Again, as regards the returns or profits of the method of farming I recommend, I think I shall best avoid a very uncertain and unsatisfactory discussion by giving, not the actual figures of a balance-sheet, but the extra results arising from improved methods, which any one experienced in farming can add to the average prices of his own neighbourhood, and compare with the different values of land and produce which there prevail, according to soil, climate, and situation. The reader will thus be enabled to adapt my suggestions to his own individual position, and will not so readily take exception to figures which, however correct in my case, may be quite inapplicable in another's, or to profits which may be as unreasonably large in one man's opinion, as they are small in that of another. I shall also assume (as the Chancellor of the Exchequer does) that a sum equal to half the rent is a fair annual profit for a tenant.

Nearly thirty years ago I was forcibly impressed with the fact, that land let to a farmer on one side of a boundary-hedge fetched about 30s. per annum, and the adjoining land, in precisely the same circumstances, was taken by a market-gardener at 5l.; while the latter was making money, the farmer could barely get a living. I therefore determined to try for myself whether, without losing my position and independence as a farmer, I could not realise some advantage from having a large body of consumers in my immediate neighbourhood, and, luckily, began with a few acres at first to learn my lesson and put my ideas to the test of practice. My first efforts were, as is usual with young beginners, unsuccessful. I endeavoured to grow vegetables for sale, supplied straw to butchers and horse-

keepers, receiving dung in return ; but I soon discovered, what I now find to be a general rule in all trades, that the retail dealer—*i. e.* the middle-man between the producer and the consumer—reaps all the profit. I grew some excellent crops of vegetables, but could not sell them unless I went about myself with a handbarrow. For cabbages—sold in the shops at 2*d.* a head, or turnips realising 2*d.* a bunch, which at this rate would have realised 20*l.* per acre—I was offered 3*d.* or 4*d.* per dozen by the greengrocer. This, with the trouble of weeding out all the inferior ones, and the drawback of cleaning and delivering in small lots, and waiting for the money, at last produced a worse return than I could obtain by feeding cows. Early peas gave the same result. A fine crop, which at the greengrocer's price of 1*s.* per dish would have made 40*l.* to 50*l.* per acre, only brought me many shillings less than I made eventually by selling the produce as seed.\* This was my first disappointment. I now find that I can sell a fair quantity of potatoes during the winter, and now and then a few tons of mangold-wurzel or carrots in the spring, at very remunerating prices ; but as soon as there is any general demand for these, the farmers at a distance glut the market, and reduce the price to little over the feeding value.

My next disappointment was my dung-heap. Though I got for the straw some hard cash besides the manure, this barely covered the expense of getting it out of the pit (always up a narrow courtyard) and loading. And after all it was not spit-dung ; some was only dirty straw, and had to be used again under my own cattle ; some was so heated and fire-fanged that it was not fit for the heap—all had to be turned over once or twice before it was fit to plough in ; so that it cost me full 5*s.* a cart-load by the time I had spread it ; and I found I could make my own straw into dung at that price. I now sell all the straw I can spare at from 50*s.* to 60*s.* the ton, and buy good spit-dung, fit for use, as I want it—that is to say, when I have leisure to fetch it, and land ready to receive it. Having bought thus much of experience, I took in hand the rest of the farm, consisting of 100 acres of arable, and rather more of meadow-land, from which I have succeeded in reaping a considerable increase, if not the full amount of my hopes, in rent and profit. Two objects have

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\* I am informed on good authority that near Tamworth the *farmer* makes about 12*l.* 10*s.* for a good crop of green peas, sold standing in his field. They are grown to supply Birmingham. Sangster's No. 1 is a favourite variety. The proximity both of canal and railroad is favourable. Several gardeners in this neighbourhood hire 40 or 50 acres, at rents varying from 8*l.* to 10*l.* per acre, and employ from 20 to 30 men. The dry sewage refuse and sweepings of Birmingham are here rising in repute both for garden crops and for pasture : at Tamworth such manure often sells for 4*s.* per ton, little more than cost of carriage by barge—the supply exceeds the demand.—P. H. F.

been kept constantly in view—to increase the quantity and quality of the dung; and, as a consequence, to grow the utmost amount of saleable produce. I now keep a herd of above 30 cows, or about 25 in full milk all the year round. These are soiled in the house, except from Midsummer to Michaelmas, when they go out into the meadows. They are fed in winter on chopped hay, straw, and roots, with bought grains, malt-dust, and a little meal. The milk is sold to milkmen, who fetch it from the cow-house door, and pay 2*d.* a quart, ready money. Each cow produces 20*l.* per annum, which, I reckon, pays for her keep, leaving me the dung for the litter. This latter I economise as far as possible by running all the liquid into a tank, to be drawn over the grass-land; a very small quantity of straw is then required to absorb the remainder. This is further improved by the manure of 100 pigs fatted every winter. With this, and the help of four cart-horses, I am enabled to thoroughly dress one-third of my arable land every year. I plough it in 14 inches deep, with a second plough following in the furrow of the first, and thereby secure very large crops of roots: these are nearly all drawn for the cows or for sale, the tops and refuse being left to be penned over by sheep; the second year, wheat; the third, barley, partly after stubble turnips fed off. After twenty years' repetition of this three-course rotation, I now get an average of 40 bushels of wheat, and the same of barley, the latter of prime malting quality, unless where the sheep, remaining too long on the turnips, have made it rank. By thus keeping two-thirds of my land in corn, I get a large quantity of wheat-straw for sale, of barley-straw for fodder for the cows, besides a few acres of potatoes and roots for sale. The horses and cows eat about three-fourths of the meadow-hay, and leave the rest for sale. The meadows mown every year are kept in condition by refuse ashes, road-dirt, and inferior dung bought in the town, of which large quantities can be procured for less than 2*s.* the one-horse load, or about 2*l.* per acre, every third or fourth year.

In assessing the profits of my farm, I shall compare it with 200 acres of similar land at a distance, the arable being supposed to be farmed highly on the four-course system, and cows kept for the sale of butter or calves, or beasts fatted in yards with the same amount of purchased food:—

Net produce of 30 cows, at 20 <i>l.</i> per cow	.. ..	£600
Deduct usual produce of do. at 14 <i>l.</i>	.. ..	400
		<hr/>
Leaving a profit on selling milk	.. ..	£200
Arable produce of 33 acres of wheat × 5 qrs.	165 qrs.	
Instead of 25 acres do. × 4 qrs.	100	
	<hr/>	
Increase	65 qrs.	



Brought forward .. ..	£200
Profit on 65 qrs. at 55s. average price (nearly) ..	£180
Add 8 tons of wheat-straw .. ..	20
	<hr/> 200
Produce of 8 acres of barley additional=40 qrs., 37s.	75
Potatoes or roots sold, say 5 acres net .. ..	50
Hay sold, say 10 tons only .. ..	50
	<hr/> 575
Deductions.—Extra rates .. ..	£50
Do. cost of labour .. ..	100
Manure purchased .. ..	50
	<hr/> 200
Leaving as clear profit of suburban farm over the same under the usual management .. ..	£375

In order not to burden the above account with any unnecessary figures, I have omitted all mention of profit from sheep or pigs, which in my case is pretty much the same as in that of other people. I fat off about 100 pigs and wethers, and lamb down 100 ewes, which are sold with their lambs in the spring. The 28 acres of roots which enable me to keep this stock, besides supplying some 500 tons of mangolds, turnips, &c., to my 30 cows, manifestly give as good a return as 50 acres of fallow-crops under ordinary management.

I come now to the deductions, with which I have debited the account. I find the general rateable value of a farm situate as mine is to be about 1*l.* per acre more than if it were away from the town, and the rates, including a borough-rate instead of county-rate, to be somewhat higher; I have, therefore, deducted 50*l.* on that head. I find, too, the labour-bill is large. House-rent near towns is very high. Common labourers, through the summer, can get their half-crown or more per day, and consequently will not work at farmers' prices, even for constant employment. There is also a little more expense incurred in mending fences, bird-keeping, &c. The 50*l.* worth of ashes, &c., is as much as we have time to cart home in the course of the winter. After making these necessary allowances, the handsome balance of 375*l.*, or nearly 2*l.* per acre, remains to be divided between the landlord and the tenant. I have obtained this result now for a series of years with great regularity; indeed there is very little difference in the amount of the corn-crop between good years and bad years.

In comparing this system with others that have been recommended, I am convinced there is none more profitable, more easily adapted to all circumstances of soils, seasons, or markets. If two successive corn-crops to one root-crop be thought too scourging, nevertheless my experience tells me, that with thorough

deep cultivation and a plentiful supply of manure, the land, which was naturally poor, has improved under such treatment. I find also that I can make this manure cheaper on my own premises, taking into consideration all the attendant expenses, than I can purchase it. Indeed, on this latter point I believe that farmers very generally deceive themselves. Partly owing to prohibitions in their leases to sell straw, and partly from a habit of looking at the size of their dung-heap, instead of calculating its quality, they have been content with spreading ten cart-loads per acre of dirty litter from a fold-yard, and calling it a dressing; whereas, if they were allowed to sell a part of it, and were to cut up a good portion for cattle food, mixed with bought cake or meal and chopped roots, they would still find that enough remained, if used economically, and under cover from rain, to absorb the excreta of three times as much stock as they now keep loose in a straw-yard. The same number of cart-loads per acre would then double the amount of the crops produced, and even at present prices leave a very handsome balance to the farmer. While meat and wool are dear and offal corn so cheap, I believe that manure can be made for nothing; deep cultivation, therefore, with thorough manuring and great attention to cleanliness, will enable any man to follow my rotation with the same result. As roads improve and railway stations multiply, every farm is becoming comparatively more suburban—that is, nearer to the dearest market for sale of bulky produce, and to the cheapest for the purchase of feeding-stuffs or manures. With this encouragement, let the agriculturist deepen his soil gradually, using an admixture of the subsoil to freshen the top-soil; he will then find his crops annually increasing, and his land less dependent on a wet or dry season. When he realises, as I have attempted to show he may do, a net increase of 30s. to 40s. per acre, he will not grudge his landlord an extra rent. Should he succeed in so doing, he will be ready to thank me for publishing my experience. Should he fail on the first trial, as I did, let him not despair nor charge the drought or the blight with having caused his ill-success; but, putting his faith in the bounteous gifts of Nature, let him redouble his efforts after clean, deep cultivation, with high manuring, and he will assuredly not lose his reward.

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XVI.—*On the Absorption of Potash by Soils of Known Composition.* By Dr. AUGUSTUS VOELCKER.

We are indebted to Professor Way for a series of remarkable experiments, showing that soils not only possess the power of abstracting free potash from its solution in water, but are capable also of separating this important alkali from its saline combinations. Since the publication of Professor Way's interesting and highly valuable Papers "*On the Absorbing Properties of Soils*," I have been engaged in studying the changes which liquid fertilizing matters undergo in contact with soils of known chemical composition.\*

As a further instalment to these soil-studies, I have now the pleasure of recording the results of experiments made with a view of ascertaining to what extent soils of various chemical characters absorb free potash from its solution in water, and to what extent the same soils separate potash from its soluble salts and retain it in a comparatively speaking insoluble state.

1. SERIES OF EXPERIMENTS ON THE ABSORPTION OF CAUSTIC POTASH.

Clay soils, it is well known, possess in a high degree the power of absorbing potash, and this they are generally considered to exert with greater or less avidity according as the clay varies in stiffness. On the other hand, sandy soils are believed to be deficient in this power of fixing potash, which next to phosphoric acid and ammonia, is, no doubt, the most valuable fertilizing constituent. These conclusions confessedly rest on a very limited range of experience, so that any additional information on this subject will be of some use. The soils selected for the following six experiments were :—

1. A calcareous soil.
2. A stiff clay.
3. A fertile sandy loam.
4. Soil from a pasture, being a vegetable mould, containing abundance of organic matter, and a fair proportion of sand and clay.
5. A marly soil.
6. A sterile sand, containing a good deal of organic matter and scarcely any lime.

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\* The results of experiments on this subject have been published by me in this Journal, in Papers bearing the respective titles : "*On the Changes which Liquid Manure undergoes in Contact with Soil*;" "*On the Chemical Properties of Soils*;" and "*On the Absorption of Soluble Phosphate of Lime*."

The potash solution used alike in all six experiments was produced by dissolving 40·47 grains of chemically pure hydrated caustic potash, KO, HO, in four decigallons (28,000 grains) of water. The solution consequently contained ·1445 per cent. of hydrated caustic potash, or ·1213 per cent. of anhydrous potash.

*Experiment No. 1.—Absorption of Caustic Potash by Calcareous Soil.*

This soil on analysis yielded the following results :—

Moisture .. .. .	3·62
Organic matters .. .. .	4·23
Carbonate of lime .. .. .	67·50
Oxides of iron and alumina .. .. .	7·54
Magnesia .. .. .	·44
Potash and soda .. .. .	·79
Insoluble siliceous matter .. .. .	15·88
	<hr/>
	100·00

It will be observed that this soil, in which carbonate of lime is the preponderating constituent, contains but little clay and organic matter ; it is, in point of fact, a chalk marl. The potash solution, as stated above, was placed with 3,500 grains of this soil in a glass-stoppered bottle, and left in contact with it for four days, during which time this mixture was shaken up at intervals, and then allowed to settle. A decigallon of the liquid was then drawn off and filtered perfectly clear. The clear liquid was then boiled with baryta water, and by this means all earthy matters taken up from the soil were removed. The excess of baryta was next removed, and the resulting liquid having been evaporated to dryness, the residue was heated strongly, and the potash in it determined by bi-chloride of platinum.

Anhydrous Potash (K O).									
Before contact with the soil, 1000 grains of the								} 1·213	
solution contained .. .. .									
After contact .. .. .								} ·413	
Difference .. .. .								<hr/> ·800	

·8 of a grain of anhydrous potash was thus fixed in the soil from each 1000 grains of solution, consequently 22·40 grains were removed from the whole solution (28·000 grains), and fixed by 3500 grains of soil. 1000 grains of this calcareous soil thus absorbed 6·40 grains of potash. In this experiment it appears that, in round numbers, two-thirds of the potash was absorbed, and one-third remained in solution.



*Experiment No. 2.—On Stiff Clay.*

The clay used in this experiment was an extremely stiff and retentative Essex clay, containing but little lime and sand, as the following analysis further shows.

*Mechanical Analysis.*

	Subsoil.	Surface-soil.
Moisture .. .. .	9.46	3.91
Organic matter and water of combination	4.87	4.80
Clay .. .. .	75.29	78.13
Lime .. .. .	1.12	2.19
Sand .. .. .	9.26	10.97
	<hr/> 100.00	<hr/> 100.00

*Chemical Analysis.*

	Subsoil.	Surface-soil.
Moisture .. .. .	9.46	3.91
Organic matter and water of combination	4.87	4.80
Oxides of iron and alumina .. .. .	17.38	7.85
Phosphoric acid .. .. .	.06	.04
Carbonate of lime .. .. .	1.02	2.08
Sulphate of lime .. .. .	.13	.15
Magnesia .. .. .	.92	.32
Alkalies and loss .. .. .	.45	
Insoluble siliceous matter (chiefly clay)	65.71	80.85
	<hr/> 100.00	<hr/> 100.00

1750 grains of subsoil and an equal quantity of surface soil were shaken up in a bottle with the potash-solution, and allowed to remain in contact for a period of four days. One decigallon of the liquid was then filtered off, and the amount of potash accurately determined, as in the preceding experiment.

		Anhydrous Potash (K O).
Before contact with soil the solution contained, in		
1000 grains .. .. .	}	1.213
After contact .. .. .		.399
Difference .. .. .		<hr/> .814

The whole liquid employed in this experiment consequently parted with 22.792 grains of caustic potash, which were fixed by 3500 grains of soil. 1000 grains of this clay accordingly absorbed 6.51 grains of anhydrous potash.

*Experiment No. 3.—On a Fertile Sandy Loam.*

The soil used in this experiment was a friable, red-coloured, fertile, light, turnip loam, and yielded on analysis the following results :—

### 336 *Absorption of Potash by Soils of known Composition.*

Moisture .. .. .	2.95
Organic matter and water of combination ..	6.75
Oxides of iron and alumina .. .. .	6.10
Carbonate of lime .. .. .	1.22
Alkalies and magnesia .. .. .	1.20
Insoluble siliceous matter (sand and same clay)	82.22

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100.44

The solution of potash was combined with 3500 grains of this soil and treated as before.

	Anhydrous Potash.
4 decigallons of potash, solutions, before contact	} 33.966
with 3500 grains of soil, contained .. .. .	
After contact .. .. .	14.031
Potash absorbed by the soil .. .. .	19.935

According to these determinations, 1000 grains of the fertile turnip loam absorbed only 5.69 of anhydrous potash, which is less than the quantity absorbed from a solution of the same strength by the stiff clay and the calcareous subsoil used in the preceding experiments.

#### *Experiment No. 4.—On Pasture Land.*

The analysis of this soil yielded the following results :—

Moisture .. .. .	2.420
Organic matter .. .. .	11.700
Oxides of iron and alumina .. .. .	11.860
Carbonate of lime .. .. .	1.240
Sulphate of lime .. .. .	.306
Phosphoric acid .. .. .	.080
Chloride of sodium .. .. .	.112
Potash (soluble in acid solution) .. .. .	.910
Soluble silica .. .. .	4.090
Insoluble siliceous matter .. .. .	67.530

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100.248

The insoluble siliceous matter here mentioned consists of about equal proportions of clay and sand. The soil, it will be seen, is rich in organic matter, and also contains a fair proportion of soluble potash. Like other pasture land, rich in organic matter, it is rather deficient in lime, and would be much improved by liming or marling. The experiment was in this instance carried out in precisely the same manner as before.

	Anhydrous Potash.
Before contact with the soil, 1000 grains of potash	} 1.213
solution contained .. .. .	
After contact .. .. .	.390
Difference .. .. .	.823

Accordingly 1000 grains of this pasture land absorbed 6·57 of potash.

*Experiment No. 5.—On a Marly Soil.*

The soil employed in this experiment, on analysis, was found to contain in 100 parts :

Moisture .. .. .	4·72
Organic matter and water of combination .. ..	11·03
Oxides of iron .. .. .	9·98
Alumina .. .. .	6·06
Carbonate of lime .. .. .	12·10
Sulphate of lime .. .. .	·75
Magnesia and alkalies .. .. .	1·43
Soluble silica (soluble in caustic potash) .. ..	17·93
Insoluble siliceous matter (chiefly clay) .. ..	36·00
	<hr/>
	100·00

The experiment was made precisely as before, with the following result:—

	Anhydrous Potash.
Before contact with soil, the solution contained ..	33·966
After 4 days contact .. .. .	8·554
	<hr/>
Potash absorbed by 3500 grains of soil ..	25·412

1000 grains of this soil accordingly absorbed 7·26 grains of anhydrous potash. In this experiment more potash was absorbed than by any of the preceding soils, not excepting even the stiff clay. It will also be noticed that this marly soil contained a large proportion of soluble silica, as well as a considerable amount of oxide of iron and alumina. I find that soluble silica and the hydrated oxides of iron and alumina possess the power of fixing potash in a large proportion, and their presence in a well cultivated clay or marly soil affords thus a guarantee for its retention of potash. In many stiff clays, however, that have never been exposed to the ameliorating influence of the atmosphere, the oxides of iron and alumina, as well as silica, occur in a state in which they are not readily acted upon even by powerful chemical re-agents, and in this condition we have good grounds for believing they do not possess the power of absorbing potash or ammonia in any marked degree. Good and deep cultivation, by facilitating the action both of air and water, not only unlocks the mineral treasures already stored in the soil, but also brings the land into a mechanical and chemical condition, which enables it to retain the fertility imparted to it by natural or artificial manures.

*Experiment No. 6.—On Sterile Sand.*

The soil selected for experiment was a very sterile, red, ferruginous sand, containing scarcely any clay, mere traces of lime, and much oxide of iron, as will be seen by the following analysis :—

Water .. .. .	1·43
*Organic matter .. .. .	3·39
Oxides of iron and alumina .. .. .	12·16
Carbonate of lime .. .. .	·15
Alkalies and magnesia .. .. .	·46
Insoluble siliceous matter (sand) .. .. .	82·41
	<hr/>
	100·00
*Containing nitrogen .. .. .	·21
Equal to ammonia .. .. .	·25

3500 grains of this soil left in contact with the potash solution for four days gave the following results :—

	Anhydrous Potash.
Before the experiment the solution contained ..	33·966
After .. .. .	12·413
	<hr/>
Potash absorbed by 3500 grains of soil ..	21·553

1000 grains of this sterile sand consequently absorbed 16·16 grains of caustic potash. In this series of experiments the following quantities of caustic potash were thus absorbed by 1000 grains of

	½ Potash (K O).
	<hr/>
	Grains.
1. Calcareous soil .. .. .	6·40
2. Heavy clay .. .. .	6·51
3. Fertile sandy loam .. .. .	5·69
4. Pasture land .. .. .	6·57
5. Marly soil .. .. .	7·26
6. Sterile sand .. .. .	6·16

These six soils differ greatly in their physical and chemical constitution, ranging from the heaviest clay land at the one extremity to the lightest of poor sands on the other. In every instance a considerable proportion of caustic potash was absorbed; it may therefore be safely inferred that all soils, no matter what their composition, possess the power of separating caustic potash from its solution in water. This power, as has been already shown, differs in various kinds of soils, and is sometimes greater in poor or sterile soils than in good or rich arable or pasture land. However, with respect to the absolute quantity of potash which a soil is capable of absorbing, we must be careful to avoid a hasty judgment, for actual experiments show that the amount of potash which is fixed by a given quantity of soil depends



on a variety of conditions. Thus 1000 grains of a soil which in one experiment is found to separate 561 grains of caustic potash from a weak solution, will take up two, three, and four times as much if brought into contact with a much stronger solution. Therefore, as in the case of caustic ammonia, the strength of the solution materially affects the amount of potash retained by the soil. Again, the relative proportions of soil and liquid determine in some measure the quantity of potash absorbed. These two circumstances, therefore, in addition to the variations in the purely chemical constitution of different soils, materially affect the result. Another striking similarity between the absorption of potash and that of ammonia is presented to us in the fact that the absorption by the soil of these and, in all probability, of other fertilizing matters, is never complete. It does not matter whether a strong or a weak solution of potash is passed through a soil, whether more or less of liquid is employed, or in what way the experiment is modified, in every case the liquid after its passage through the soil will be found to contain more or less potash, showing that its complete absorption by the soil, even under the most favourable conditions, is impossible.

## 2ND SERIES OF EXPERIMENTS.—ABSORPTION OF POTASH FROM A SOLUTION CONTAINING CARBONATE OF POTASH.

I have much pleasure in recording here some careful experiments made some years ago in my laboratory by Mr. Charles Philips, a pupil of mine, who took particular interest in my investigation of the absorbing properties of soils. At my request Mr. Philips experimented with two soils,\* which possess similar general characters, but differ chiefly in the proportions of carbonate of lime which they contain. Both are calcareous clay soils, of moderate depth, and tolerably open character. They both contain clay in preponderating proportions, and hardly any sand which can be separated by washing. Submitted to analysis by Mr. Philips they gave the following results:—

### *A. Mechanical Analysis.*

	No. 7.	Field.	No. 12.
Moisture .. .. .	8.81	...	13.29
Organic matter and water of combination	8.63	...	9.81
Lime .. .. .	4.98	...	9.17
Sand .. .. .	2.82	...	4.88
Clay .. .. .	74.76	...	62.85
	<hr/> 100.00		<hr/> 100.00

\* Taken from fields on the farm attached to the Royal Agricultural College Cirencester, marked No. 7 and No. 12 on the map.

*B. Chemical Analysis.*

	No. 7.	Field.	No. 12.
Moisture .. .. .	8·81	...	13·29
Organic matter and water of combination	8·63	...	9·81
Oxide of iron .. .. .	14·28	...	16·72
Alumina .. .. .	3·29	...	2·46
Carbonate of lime .. .. .	4·61	...	8·97
Sulphate of lime .. .. .	·37	...	·28
Magnesia .. .. .	1·03	...	·55
Potash .. .. .	·46	...	·88
Soda .. .. .	·21	...	·33
Phosphoric acid .. .. .	·21	...	·03
Chloride of sodium .. .. .	·02	...	·02
Soluble silica .. .. .	8·20	...	4·29
Insoluble siliceous matter .. .. .	50·10	...	42·20
	<hr/> 100·21		<hr/> 99·83

A watery solution containing ·55657 per cent. of pure carbonate of potash was employed in the following experiments.

3500 grains of each soil were mixed with 7000 grains of this solution, and after repeated agitations left to stand for twenty-seven hours. A portion of the liquid was then drawn off, boiled with baryta-water; the excess of baryta-water was next removed by carbonate of ammonia and a little free ammonia, and the filtrate evaporated to dryness; the residue was heated to redness, and then the potash determined by chloride of platinum. The following are Mr. Philips's results:—

	Carbonate of Potash.	
	Soil No. 7.	Soil No. 12.
	Grains.	Grains.
Before contact with soil the solution contained	38·9599	.. 38·9599
After contact .. .. .	8·5512	.. 11·0306
	<hr/>	<hr/>
Difference .. .. .	30·4087	27·9293

Therefore 1000 grains of this soil from field No. 7 absorbed 8·6882 grains of carbonate of potash, equal to 5·9179 of anhydrous caustic potash. 1000 grains of the soil, from field No. 12, absorbed 7·9798 of carbonate, equal to 5·4355 of anhydrous caustic potash.

### 3RD SERIES OF EXPERIMENTS.—ABSORPTION OF POTASH FROM A SOLUTION CONTAINING SULPHATE OF POTASH.

*Experiments No. 1 and 2.*

In the next two experiments a solution containing ·62128 per cent. of pure sulphate of potash was combined with the same two soils in the same proportions as before. Mr. Philips obtained the following results:—

	Potash, calculated as Sulphate of Potash.	
	Soil No. 7.	Soil No. 12.
	Grains.	Grains.
Before contact with soil the solution contained	42·4896	42·4896
After contact .. .. .	11·7939	11·3347
Difference .. .. .	30·6957	31·1549

1000 grains from field No. 7 absorbed 4·7148 of potash, equal to 8·7702 of sulphate of potash. 1000 grains of soil from field No. 12 absorbed 4·8088 of potash, corresponding to 8·9014 grains of sulphate of potash. On comparing these results with those previously obtained on the same soils with carbonate of potash, it appears that potash was not separated in so large a proportion from its combination with sulphuric as from that with carbonic acid.

*Experiment No. 3.—On the Sulphate of Potash on a Marly Soil.*

The soil in this instance was the same on which the experiment with caustic potash had been made. 1 lb. of this soil was mixed with 8 decigallons of distilled water and 120·8 grains of pure sulphate of potash. The greater portion of the solution was drawn off after standing four days. 2 imperial pints of the perfectly clear solution on evaporation to dryness gave a residue, weighing 37·77 grains, dried at 300° Fahr.

This residue, on analysis, gave the following results:—

	Grains.
Organic matter and water of combination (loss on heating) .. .. .	1·690
Soluble silica .. .. .	·050
Oxides of iron and alumina, with traces of phosphoric acid .. .. .	·050
Sulphate of lime .. .. .	12·294
Sulphate of magnesia .. .. .	·617
Sulphate of potash .. .. .	22·272
Chloride of potassium .. .. .	·470
Chloride of sodium .. .. .	·390
	<hr/> 37·833

According to these determinations, the total solution (8 decigallons) after contact with 1 lb. of soil, contained:—

	Grains.
Organic matter and water of combination .. .. .	5·408
Soluble silica .. .. .	·160
Oxides of iron and alumina, and traces of phosphoric acid .. .. .	·160
Sulphate of lime .. .. .	39·340
Sulphate of magnesia .. .. .	1·974
Sulphate of potash .. .. .	71·270
Chloride of potassium .. .. .	1·504
Chloride of sodium .. .. .	1·248
	<hr/> 121·064

This amount of solid matter is nearly identical with that which the solution contained before the admixture, viz., 120·8 grains; but it is no longer exclusively sulphate of potash, but a combination of salts, in which sulphate of potash and sulphate of lime are most conspicuous.

It will be remembered that this soil contained a good deal of carbonate of lime, and it will be seen at a glance that whilst a certain amount of potash became fixed, the sulphuric acid with which the potash was originally combined passed through the soil principally in union with lime. Before filtration the solution contained:—

	Grains.									
Sulphuric acid .. .. .	..	..	..	..	..	..	..	..	..	55·540
Potash .. .. .	..	..	..	..	..	..	..	..	..	65·260
										<hr/> 120·800

After filtration through the soil, the whole solution contained potash, 39·565 grains; consequently, 25·695 grains of potash were absorbed by 1 lb. or 7000 grains of soil, and 1000 grains of soil absorbed 3·671 grains of potash.

The sulphuric acid in the liquid after filtration through the soil is distributed as follows:—

23·141	grains are united with lime <sup>7</sup>		
32·653	”	”	potash and
1·316	”	”	magnesia.
<hr/>			
or 57·110 grains of sulphuric acid altogether.			

No absorption whatever of sulphuric acid thus took place. Indeed, the filtered liquid contained a little more sulphuric acid than originally existed in the 120·8 grains of sulphate of potash. This slight excess arises from a small quantity of sulphate of lime naturally existing in the soil, which augments the quantity produced by the sulphuric acid of the decomposed sulphate of potash.

The preceding analytical results are interesting, as affording a positive proof of the fact that a solution of a single salt like sulphate of potash in percolating cultivated soils, gives rise to a great variety of new chemical soluble combinations, several of which exercise important functions in the nutrition of plants.

*Experiment No. 4.—With Sulphate of Potash on a Sterile Sandy Soil.*

For comparison with the preceding experiment, a solution of sulphate of potash was tried upon the sandy soil, of which the analysis will be found in the early part of this Paper (see p. 338, supra).



The experiment was conducted in precisely the same manner as in No. 3.

2 imperial pints of the solution, after contact with the sandy soil, on evaporation, gave a residue, which dried at 300° Fahr., weighed 37,700 grains. This residue, on analysis, yielded the following results:—

Organic matter and salts of ammonia .. .. .	2540
Soluble silica .. .. .	040
Oxides of iron and alumina, with traces of phos- phoric acid .. .. .	040
Sulphate of lime .. .. .	1550
Sulphate of magnesia .. .. .	504
Chloride of potassium .. .. .	932
Sulphate of potash .. .. .	31847
	<hr/>
	37453

The sum total of the separate constituents of this residue, it will be seen, agrees as well as can be expected with the amount obtained by direct evaporation of 2 pints of liquid.

Calculated for 8 decigallons of liquid brought in contact with one pound of soil, we obtain the following results:—

	Grains.
Organic matter and salts of ammonia .. .. .	8128
Soluble silica .. .. .	128
Oxides of iron and alumina, with traces of phos- phoric acid .. .. .	128
Sulphate of lime .. .. .	4960
Sulphate of magnesia .. .. .	1612
Chloride of potassium .. .. .	2982
Sulphate of potash .. .. .	101910
	<hr/>
	119848

Before contact with soil, the whole solution contained 120·8 grains of solid matter; after contact, 119·848 grains, or very nearly the same amount. Whilst, however, the concentration of the filtered liquid was scarcely altered, its composition underwent material changes in its passage through the soil.

Before the experiment the solution contained:—

	Grains.
Potash and sulphuric acid .. .. .	65260
	55540
	<hr/>
	120800

After filtration through the soil, the whole solution contained potash, 56·936 grains; consequently, 8·324 grains of potash were absorbed by 7000 grains of soil, or 1000 grains of soil absorbed in this experiment only 1·189 grains of potash.

The sandy soil thus possessed the power of absorbing potash from a solution of sulphate of potash, in a very much more feeble

degree than the marly soil, which it will be noticed absorbed from the same solution more than three times as much potash.

The residue obtained on evaporating the filtered liquid, contained 50·847 grains of sulphuric acid, of which

46·855	were united with	potash
2·917	”	”
1·075	”	lime and
	”	magnesia
<hr/>		
50·847		

Before filtration, the solution contained 55·540 of sulphuric acid. It would appear, therefore, that sulphuric acid, as well as potash, was absorbed in this experiment. This, however, is not the case; for, on making a separate sulphuric acid determination in another portion of the solution after contact with soil, and avoiding previous evaporation to dryness, I find in 8 decigallons 56·368 grains of sulphuric acid, that is, a slight excess over the quantity of sulphuric acid in the 120·8 of sulphate of potash, which were dissolved in 8 decigallons of distilled water. It is evident, therefore, that the evaporation to dryness of the filtered liquid and heating of the residue, had the effect of dissipating a considerable proportion of sulphuric acid. But as the filtered liquid had no acid reaction, the acid could not be present in a free state, and the question arises in what state of combination did it exist?

The experimental soil, it may be mentioned, had received rather a heavy dressing of Peruvian guano. Digested with water, it gave a brownish-coloured solution, which afforded distinct indications of the presence of ammonia. A portion of sulphuric acid, originally united with potash, doubtless passed into the filtered liquid in combination with ammonia.

As sulphate of ammonia, like all salts of ammonia, is volatile at a high temperature, the evaporated and strongly-heated residue of the filtered liquid could not contain any sulphate of ammonia; the analysis of this residue consequently yielded less sulphuric acid than the liquid from which it was obtained. A careful determination of the amount of ready-formed ammonia in this soil showed that it contained ·103 per cent. of ammonia. As 1 lb. of soil was used in the filtration experiment, this evaporation of ready-formed ammonia in the soil is quite sufficient to combine with the quantity of sulphuric acid that escaped on heating the solid matter left on evaporation of the filtered liquid.

The result of this experiment is interesting in several respects.

1. On comparing the results obtained in passing a solution of sulphate of potash through the soil, it will be noticed that much less potash was retained than was the case when caustic potash was

filtered through the same soil. This sandy soil contains a good deal of hydrated oxide of iron, a constituent well known to possess considerable chemical affinity for caustic potash, and none for sulphate of potash. In consequence of this special display of chemical affinity which manifests itself when a solution of caustic potash is passed through a soil containing hydrated oxide of iron, more potash was fixed than when a solution of sulphate of potash was brought into contact with the same soil.

2. It is worthy of special notice that the solution of sulphate of potash after filtration through the sandy soil contained a weighable quantity of sulphate of ammonia, which was not the case with the marly soil in the preceding experiment.

The power of soils to retain ammonia is generally assumed to be greater than their power of retaining potash. Here, however, an instance is presented to us in which a salt of potash, by acting on the ammoniacal combination in a soil, overcomes the supposed superior affinity of ammonia. Contrary to all expectation, ammonia, in combination with sulphuric acid evidently supplied by the sulphate of potash, passed into the solution, whilst potash took its place and was retained in the soil.

3. On comparing the analysis of the sterile sand with that of the marly soil, it will be seen that, whilst the former is very poor in lime, the latter contains it in a large proportion. In the sandy soil but little sulphate of lime was produced, on account of the deficiency of lime in the soil; and the consequence was, that sulphate of ammonia, as well as sulphate of lime, passed through the soil. In the case of the marly soil, there was sufficient lime present to lay hold of the sulphuric acid separated from sulphate of potash on the fixation of potash by the soil, and no sulphate of ammonia—at least not any appreciable quantity, passed through it. In other words, in these experiments the deficiency of lime in the sandy soil caused the elimination and loss of valuable ammoniacal compounds, which were retained in the marly soil. Under favourable circumstances, lime thus becomes, as in the case before us, a preserver of ammoniacal compounds in the soil.

4. The preceding experiments throw new light on the uses of lime in agriculture. We know practically how essential the presence of lime is for the healthy growth of every kind of cultivated produce. On soils very deficient in lime, most crops, especially green crops, are subject to all kinds of disease; and, consequently, roots fail altogether on such land, even if it has been liberally manured with good yard-dung or guano. Up to a certain stage, corn and roots grown under such conditions appear to thrive well, but as the season advances they sustain a check, and at harvest-time yield a miserable return. The remedy for such failures, which are not at all uncommon in

localities where poor sandy soils prevail, is a good dose of lime or marl, and then, and only then, farmyard manure or guano may be applied to the greatest advantage. Marl or lime alone does not suffice for meeting all the requirements of our cultivated crops on such poor sands, and though calcareous minerals supply a most necessary element of plant-food, and by acting on the latent stores of food in the soil, produce at first a most strikingly favourable effect upon vegetation, they soon fail to produce the desired effect if repeated too often, to the exclusion of other fertilizing matters. On the other hand, the most liberal application of farmyard manure of the best quality never produces so beneficial and lasting an effect on poor sandy soils as when they have been previously well marled or limed. On such land no doubt the proverb holds good:—

“Lime and marl without manure  
Only make the farmer poor.”

But at the same time I have a strong impression that on such land manure, without lime or marl, does not help much towards paying the rent. There are some soils which swallow up manure, with, so to speak, no satiable appetite, without ever feeling the better for the manure; they are appropriately called very hungry. On all such soils I have no hesitation in saying much manure is wasted, or the most is not made of it, if previously to the application of farmyard-manure, guano, &c., the land has not received a good dose of marl or lime.

My recent filtration experiments point out the reason why marl or lime is peculiarly valuable on poor sands. It is not merely by supplying in a direct manner a deficient element of nutrition that lime acts so beneficially on such soils, but because it preserves in the soil the more valuable fertilizing matters, which, like salts of potash or ammonia, rapidly filter through sandy soils, unless a sufficient quantity of marl or lime has been previously applied to the land. By these means the bases of the more valuable saline soluble constituents of rotten dung or of guano are retained in the soil, whilst the acids filter through it in combination with lime, a constituent which is, comparatively speaking, inexpensive.

#### 4TH SERIES.—EXPERIMENTS WITH A SOLUTION OF CHLORIDE OF POTASSIUM.

##### *Experiment No. 1.—On Calcareous Soil.*

3500 grains of calcareous soil\* were mixed with a solution of 52·91 grains of pure chloride of potassium in 4 decigallons

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\* For analysis see p. 334.



of water; after standing four days the liquid was filtered off and the potash carefully determined.

	Chloride of Potassium.	Potash.
Before the experiment the solution contained	52·910	= 33·378
After contact with soil .. .. .	33·044	= 20·854
Difference .. .. .	19·866	= 12·524

Thus 3500 grains of soil absorbed 12·524 grains of potash contained in 19·866 grains of chloride of potassium, or 1000 grains absorbed 3·578 of potash. The amount of chlorine in 52·910 of chloride of potassium is 25·248 grains.

In the liquid, after passing through the calcareous soil, I found 25·324 grains of chlorine. The soil, therefore, absorbed no chlorine whatever.

*Experiment No. 2.—On Clay Soil.*

This and the next two experiments were made in precisely the same manner as No. 1.

	Chloride of Potassium.	Potash.
Before filtration the solution contained .. .. .	52·910	= 33·378
After filtration .. .. .	30·884	= 19·483
	22·026	= 13·895

1000 grains of soil consequently absorbed 3·97 of potash.

*Experiment No. 3.—On a Fertile Light Sandy Loam.*

	Chloride of Potassium.	Potash.
Before the experiment the solution contained	52·910	= 33·378
4 decigallons .. .. .	40·468	= 24·188
After contact with soil .. .. .	12·442	= 9·190

1000 grains of soil, therefore, absorbed 2·626 grains of potash. This soil, it will be seen, absorbed a good deal less potash than the clay soil.

*Experiment No. 4.—On Pasture Land.*

	Chloride of Potassium.	Potash.
Before the experiment the solution contained	52·910	= 33·378
After contact with soil .. .. .	32·060	= 20·225
	20·850	= 13·153

1000 grains of this soil thus absorbed 3·758 grains of potash. In the filtered liquid which passed through this soil, I found 25·32 of chlorine, chiefly in combination with lime, which

agrees almost exactly with the amount of chlorine in 52·910 of chloride of potassium. Another proof is here given that the electro-negative portion of the chloride of potassium entirely passed through the soil, and the base of the decomposed salt alone was absorbed by the soil.

*Experiments No. 5 and 6.—On Calcareous Clays.*

The two following experiments were tried by Mr. Philips on soils from fields No. 7 and No. 12 of the Royal Agricultural College farm :—

The solution of chloride of potassium was much stronger than that employed in the preceding experiments. In both experiments a solution containing 6617 per cent. of chloride of potassium was used. 3500 grains of each soil were shaken up in a bottle with 7000 grains of this solution of chloride of potassium. After a lapse of 24 hours, the greater portion of the liquid was filtered off perfectly clear, and the potash determined in a weighed quantity.

The following results were obtained by Mr. Philips :—

*Experiment No. 5.—Soil from Field No. 7.*

	Chloride of Potassium.	Potash.
Before filtration the solution (7000 grains) contained .. .. .	46·319	= 29·221
After filtration .. .. .	18·207	= 11·487
Difference .. .. .	28·112	= 17·734

Consequently 1000 grains of soil absorbed 5·066 grains of potash.

*Experiment No. 6.—Soil from Field No. 12.*

	Chloride of Potassium.	Potash.
Before the experiment the solution contained .. .. .	46·319	= 29·221
After contact with soil .. .. .	8·020	= 5·059
Retained by 3500 grains of soil .. .. .	38·299	= 24·162

1000 grains of soil thus absorbed 6·903 of potash.

These filtration experiments, No. 5 and 6, show that soils absorb a much larger quantity of potash from a stronger solution of chloride of potassium than from a more dilute one.

*Experiment No. 7.—On Sterile Sandy Soil.*

In this and the next experiment 7000 grains of soil were shaken up with a solution of 104·55 grains of chloride of potassium in 8 decigallons of water; the liquid was drawn off after four days, and analysed. 2 pints on evaporation gave a residue which, dried at 300° Fahr., weighed 32·540 grains.

On analysis, this residue gave the following results:—

	Grains.
Organic matter and ammoniacal salts .. .. .	2·840
Soluble silica .. .. .	·050
Oxides of iron and alumina, with traces of phosphoric acid .. .. .	·050
Sulphate of lime .. .. .	1·493
Chloride of calcium .. .. .	·033
Chloride of Magnesium .. .. .	·261
Chloride of sodium .. .. .	·110
Chloride of potassium .. .. .	27·590
	<hr/>
	32·427

According to these determinations, the whole solution (8 decigallons) contained:—

	Grains.
Organic matter and salts of ammonia .. .. .	8·088
Soluble silica .. .. .	·160
Oxides of iron and alumina, and traces of phosphoric acid .. .. .	·160
Sulphate of lime .. .. .	4·777
Chloride of calcium .. .. .	·105
Chloride of magnesium .. .. .	·835
Chloride of sodium .. .. .	·352
Chloride of Potassium .. .. .	88·288
	<hr/>
	102·765

	Chloride of Potassium.	Potash.
Before the experiment the whole solution contained .. .. .	104·550	= 65·957
After filtration through the soil, it contained .. .. .	88·288	= 55·699
	<hr/>	<hr/>
	16·262	= 10·258

1000 grains of sandy soil, according to this result, absorbed only 1·465 grains of potash. This soil thus possesses, in a much weaker degree, the power of separating potash from its chloride than any of the other kinds of soil experimented upon. The amount of chlorine in 104·55 grains of chloride of potassium (used in this experiment) is 49·819 grains. The residue that would be left on evaporation of the whole solution of chloride of potassium after filtration through the soil, contained, after heating, 42·976 of chlorine, namely:—

·063	grains in combination with calcium
·624	“ “ magnesium
·213	“ “ sodium and
42·076	“ “ potassium

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42·976

We might hence infer that chlorine had been absorbed by this soil; but having previously ascertained the presence of ammonia in the soil, we may rather assume that this entered into combination with the chlorine, and so passed out; while the potash, as evidently was the case, became fixed. Being volatile, chloride of ammonium could not be present in the residue, hence the deficiency of chlorine in the analysis of the heated residue. That chlorine was not retained by the soil appears from a direct chlorine determination which I made in the filtered solution, instead of in the residue left on its evaporation. Calculated for the whole liquid (8 decigallons) I found 49.392 of chlorine in the liquid after filtration through the soil, which agrees closely with the amount of chlorine in the chloride of potassium solution.

It is remarkable that both the solutions of sulphate of potash and of chloride of potassium in passing through this soil lost but little potash, and caused the solution of a certain amount of ammonia contained in the soil.

*Experiment No. 8.—Absorption of Chloride of Potassium on a Marly Soil.\**

Eight decigallons of the same solution as before were employed; 2 pints of the liquid filtered through the soil, on evaporation gave a residue weighing 32.781 grains, dried at 300° Fahr.

The analysis of this residue yielded the following results:—

	Grains.
Organic matter and water of combination .. .. .	1.230
Soluble silica .. .. .	.060
Oxides of iron and alumina, with traces of phosphoric acid .. .. .	.050
Sulphate of lime .. .. .	1.558
Chloride of calcium .. .. .	7.890
Chloride of magnesium .. .. .	.783
Chloride of sodium .. .. .	.348
Chloride of potassium .. .. .	20.976
	<hr/>
	32.895

In conformity with previous experience, a considerable quantity of chloride of potassium when in contact with this clay-marl was decomposed; the potash of the decomposed salt alone became fixed in the soil, and the chlorine passed out principally in combination with calcium.

According to the preceding results, the whole solution (8 decigallons) after filtration through this soil, contained:—

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\* The composition of this soil will be found in p. 337.



	Grains.
Organic matter and water of combination .. .. .	3·936
Soluble silica .. .. .	·192
Oxides of iron and alumina, and traces of phosphoric acid	·160
Sulphate of lime .. .. .	4·975
Chloride of calcium .. .. .	25·248
Chloride of magnesium .. .. .	2·505
Chloride of sodium .. .. .	1·113
Chloride of potassium .. .. .	67·123
	<hr/>
	105·252
	<hr/>
	Chloride of Potassium.
Before the experiment the solution contained .. .. .	104·550
After contact with 1 lb. of marly soil .. .. .	67·123
	<hr/>
Difference .. .. .	37·427
	<hr/>
	Potash.
	65·957
	<hr/>
	42·346
	<hr/>
	23·611

1000 grains of this soil consequently absorbed 3·373 grains of potash, or nearly three times as much as the sandy soil.

In this instance, as in all others, no absorption of chlorine took place.

	Chlorine.
Before filtration the liquid contained .. .. .	49·819
After filtration through the soil .. .. .	50·680

#### ABSORPTION OF POTASH FROM A SOLUTION OF NITRATE OF POTASH.

Under this head I have to mention only one experiment, made upon the same clay-marl that was used in several of the preceding trials.

1750 grains of this soil were shaken up in a bottle with 7000 grains of a nitre-solution containing 25·55 grains of nitrate of potash. After standing three days the liquid was filtered off, and potash and nitric acid determined in separate weighed quantities of the perfectly clear solution.

For the determination of potash the usual method was employed, and the nitric acid was determined by Dr. Pugh's excellent process.

The following were the results of this experiment:—

	Nitric Acid.	Potash.*
Before filtration the solution contained .. .. .	13·657	11·893
After filtration through the soil, it contained .. .. .	13·545	5·285
	<hr/>	<hr/>
Difference .. .. .	·112	·608

It will be seen that the liquid after filtration through the soil contained very nearly the same amount of nitric acid as the original nitre-solution. The difference in the results amounts to only about one-tenth of a grain, and is smaller than it would have

been had a less delicate and accurate plan for determining nitric acid been adopted than that recommended by Dr. Pugh.

Whilst the proportion of nitric acid in the solution before and after filtration remained unaltered, that of potash was much less in the liquid after its passage through this soil. According to the preceding results, 1000 grains of soil absorbed 3·776 of potash.

I have ascertained that the nitric acid from the decomposed portion of nitrate of potash passed through this soil almost entirely in combination with lime. The quantity of lime in the filtered solution weighed 4·270 grains; this is very nearly the theoretical equivalent for the quantity of potash fixed by the soil.

In this, as in all other cases, the base alone was absorbed by the soil, and the acid passed entirely into the filtrate. In most instances we have seen the acid of the decomposed potash-salt passed through the soil in combination with lime. Lime unquestionably has a powerful influence on the precise mode in which the absorbing properties of soils manifest themselves. Although the absence of lime in a soil does not prevent the display of the remarkable properties possessed by all soils of absorbing manuring matters, it can scarcely be doubted that the presence of much or little lime in a soil affects the precise mode in which these properties manifest themselves.

The chemical action of lime in relation to agriculture has hitherto been regarded too much apart from its connection with soil and manure. Useful information, I have no doubt, is likely to spring from a study of its use with special reference to its influence on the absorbing properties of soils.

12, *Hanover Square, London,*  
*July, 1864.*

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XVII.—*Accidents through Farm Machinery.* By FREDERICK  
ARTHUR PAGET, C.E.

THE benefits we derive from the use of steam-machinery may be said to annually increase by a law of rapid progression. But one deduction must be made from the sum total of these advantages. In a parallel line with the extending use of machines we have also an increase in number of disasters to life and limb. Machinery, like fire, is a very useful servant, but a terribly bad master. The steam "giant with one idea" has remorseless iron fingers, and woe to the living organism in their grasp. The well-made, well-kept steam-boiler is a docile instrument of wealth; but the ill-made, ill-kept boiler may at any moment turn a peaceful home-

stead into a human slaughter-house; and one can seldom take up a daily newspaper without seeing in print an account of some fresh disaster caused by such machinery. Although, in the absence of statistical figures, isolated observations and impressions are necessarily vague and controvertible, it is very probable that the number of accidents caused by machinery, and recorded in the books of infirmary surgeons, would swell into a voluminous episode of "the simple annals of the poor."

At the beginning of last year a correspondent to 'The Times' showed that, during about two years and a half, twenty-three amputations had been carried out in the Hereford Infirmary on sufferers from machine accidents; while the number of minor cases, not requiring amputation, was even higher during the same period. There can be little doubt that similar returns from other agricultural districts would show an appalling amount of misery from this cause. The "minor" accidents are only less in a surgical sense, as a leg or an arm may evidently be disabled without being cut off. But we need not go far back in the annals of the Royal Agricultural Society itself to find instances of injuries caused by machinery. At the Battersea Show a bone-crushing machine crushed to bits the living bone of its attendant up to the shoulder. At the Warwick Show a man lost his life while putting the strap on the fly-wheel of a portable engine. At the Chester Show the excellent Consulting Engineer of the Society was compelled to forbid the working of certain portable engines with insufficiently stayed boilers. The ultimate histories of these steam mortars are probably recorded in the books of some county hospital.

Three separate classes—one might almost say three separate interests—are in direct contact with agricultural machinery. The maker who, manufacturing at a great expense of skill and capital, naturally wishes to sell his productions at the highest profit; the agriculturist who, on the contrary, wants an efficient machine at as cheap a rate as possible; and, lastly, the operative, who, for the time, becomes, as it were, a human link attached to the machine. Although our implements are in general not badly made, as an immense amount of skill and thought has been spent on their construction, neither are English agricultural employers over-greedy of gain; nor farm-labourers utterly careless, still it requires but little observation to see that the three classes are—sometimes singly, sometimes all three together—to blame; and that although, according to the doctrine of chances, a certain percentage of accidents will always happen by the use of machinery, the present rate may be much reduced. No greater—indeed, no other—objection can be brought against its use.

If we examine into the originating causes of any disaster we

mostly find them fall, with more or less precision, under the following heads :—1st, A bad design, or workmanship, or material, or all three, of the machine itself; 2nd, A bad state of the machine, from neglect of its repairs, which in the case of a steam-boiler may lead to a total smash; 3rd, The inherently dangerous nature of the operation carried on; 4th, The use of machinery under exceptional circumstances; 5th, The carelessness of the operative himself. There is, perhaps, a somewhat illogical look in a classification of this kind, as all these causes are more or less in connection, but the division is, at least, convenient.

1. The direct influence of the design and general make of a machine on its safe usage requires no demonstration. It is well known that there is always a less proportion of accidents through really good and simple machines—the chance of any accident being diminished by the smaller number of working parts. It is also evident that, *cæteris paribus*, the more automatic the machine the safer is its management. But simplicity and automatic action are two apparently contradictory qualities, and extra skill on the part of the maker is no doubt required to form a happy union of the two.

Besides a construction having a due regard to the application of the machine, proper provision should be made, when practicable, to fence in or “box up” the moving parts. The clause in the Act passed some twenty years ago “for the regulation of Mills and Factories,” whereby the proper fencing of machinery was rendered obligatory, is well known to have lessened the average number of accidents through machinery in the manufacturing districts. It would be very easy to box up the gearing of a fixed thrasher, for instance, but this would certainly not be practicable with the sides of a portable machine. It would also be impossible to completely box-in a chaff-cutter; but no small number of accidents happen every year through these machines. The feed-rollers get clogged up, the attendant tries to push the straw or hay forward with his fingers, and the man’s hand gets squeezed in and cut off. The necessity for disengaging gear is here apparent. Indeed, as a rule, wherever a part in motion cannot be fenced in or boxed up, means should be provided for immediately stopping the machine. Horse-gears not fitted with a releasing arrangement—permitting the driven machinery to proceed while the horses and lay shafts stop—often lead to dreadful accidents. The now general use of wrought iron, or of malleable iron, for the beater plates of thrashers makes these machines much safer than they were a few years ago. It is well remembered that the cast-iron plates were often liable to fly to pieces under the impulse of the centrifugal force developed



by the drum. This may be cited as an instance of the increase of safety through the use of an improved material.

2. The bad state of a machine from neglected repairs can only be, humanly speaking, the fault of the employer. For however well made a machine, an engine, or a boiler, may be when it leaves the hands of the maker, no skill in its manufacture can compensate for neglect during its use. There is no more striking application for the well-known Spanish saying about the lost horse-shoe nail causing the loss of the horse than to an ill-kept boiler. A neglect of the repairs of a machine simply ends in its refusing to work. The pound saved in little repairs and "stitches in time" leads to the expenditure of 9*l.*—perhaps 90*l.*—to meet the iron-founder's bill. In this instance, the employer has only himself to blame, and he suffers accordingly. But with a *steam-boiler* the evil is greater, for an explosion leads not merely to a loss of property, but also of life. The treatment undergone by agricultural boilers is indeed sometimes incredibly bad. The universal panacea for leakages appears to be cow-dung by the barrow-full, until, at last, the water spaces get filled with solid matter. It is only by walking the hospital of the repairing-shop of some agricultural implement maker that a fair idea may be gained of the way in which these engines are often treated. Nor do the boilers that have been repaired always leave the foundry in a safe state. A strict supervision should, as a rule, be given to repairs executed by contract. Many an explosion has happened from a bad patch. Those wishing for a sound explanation of these apparently unaccountable disasters may be referred to a little work on the question, by Mr. Zerah Colburn, C.E.\* The intimate knowledge we now have of this subject—a knowledge greatly furthered by the systematic periodical examinations of the excellent Manchester Association for the Prevention of Boiler Explosions—has led most engineers to the conclusion that (supposing the boiler to have been properly made) the originating cause of an explosion is simply the neglected state in which the boiler was kept. But few engineers now believe that there is much mystery in the matter. In the simple weakening of a plate—either through undue pressure at some time or other, or through corrosion caused by leakage, or through neglected incrustation, or through burning a plate by letting the water get too low; through one or more of such causes—is a boiler explosion originated. Perhaps the rupture happily occurs *below* the water line, and then the water is simply gradually forced out, doing little or no damage. But not so when the rupture occurs *above* the water line. The super-incumbent pressure is suddenly released from a large volume of

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\* Steam-Boiler Explosions. London : John Weale, 1860.

water in a state of ebullition. According to Professor Airy, "the gauge pressure being 60 lbs. per square inch, one cubic foot of water is as destructive as one pound of gunpowder;" so that a mere rent in the boiler plate of a common portable engine when at work can be equivalent to the application of a match to a mine of gunpowder.

3. Even under the most favourable circumstances there is always some inherent risk to the attendant of a machine. Take as an instance the feeding platform of a steam-thresher, with a large opening at the level of the floor leading to a (say) 22-inch drum, revolving at the rate of 1000 revolutions per minute, and necessarily only three-quarters of an inch distant from an unyielding concave. A hooded drum is safer, but the hood impedes the feeding. A practicable self-feeding arrangement would be useful for a thrashing-machine. One or two shapes have been tried, but as yet unsuccessfully. Grinding bones by the usual machines is an inherently dangerous operation. Steam-ploughing on stony land is also a little hazardous, as the ploughman is sometimes suddenly jerked off the plough or cultivator.

4. Among instances of the use of machinery under exceptional circumstances may be classed thrashing by night in a narrow barn, by the light of a couple of cheap candles. The use of any machinery at night is always attended with greater personal risk. When a portable machine is thrashing in the open country, a high wind is apt to blow about the chaff and straw and to render it scarcely possible to keep the eyes open. In this case a good canvas hooding over the blowers and other parts is the only remedy.

5. The carelessness and ignorance of the labourer himself of course greatly swell the number of accidents through machinery; although the use of machinery is already so extensive in England that they happen but seldom from the pure ignorance of the operative. Many can be accounted for by the single word:—*Beer*. A man in the least drunk should not be allowed to come near machines, much less to act as attendant. No idlers or mere lookers on should be permitted to stand near machinery either at rest or in motion. Any hurry or confusion is also an evident source of danger.

The mere action of time is doubtless tending to diminish the number of accidents through farm machinery, as every year witnesses some advance and simplification of existing machines; but this progress will be necessarily slow, and needs some further impulse. The maker has the requisite knowledge and skill to make machinery safe; but he has not the power—the competition is too great, and prices are too small. The agriculturist would have the power, but he has not the special

engineering knowledge to tell him that an arrangement is unsafe. The labourer has neither qualification. It would evidently be to the interest of all three parties that machines should be safe.

Now, in the manufacturing districts of the North two institutions are already established for the prevention of accidents by steam-machinery. The system of factory inspection has existed with most beneficial results for more than twenty years. The Government inspectors have the power of directing the fencing off and other means for the safe usage of machinery. Emboldened by the example of the Government in this direction, the shrewd Manchester men, at the suggestion of Dr. Fairbairn, organized about seven years ago a system for the periodical inspection of steam-boilers. The Manchester Association is one of the most beneficial institutions of the country. Not merely has it saved many lives, but also much property, by teaching the proper management of the boilers and engines, and the saving of fuel. Every one of these skilled inspectors is, in fact, an instructor of steam-engineering. Could not these two systems be combined, under Government supervision, in the agricultural districts? The greater area of country covered by agricultural operations is of course a difficulty; but the agricultural shows collect machinery together, and, at least, the right of public exhibition should be refused to notoriously unsafe arrangements.

These remarks but slightly skim over a portion of an important subject. In these latter days, science has taught capital to utilize the great forces of nature; but has capital yet learnt a due regard for the safety of human labour? According to a Blue-book, published a few months ago, no less than one thousand two hundred and thirty-eight lives were lost in English coal and ironstone mines during the year 1862. Non-fatal and *merely* disabling accidents are not given. The miners are now clamouring for a greater number of government inspectors. The last published returns from the Inspectors of Factories give a total amount of one thousand five hundred and ninety-nine accidents reported for the six months previous to the 31st October, 1863. Thirty-six of these ended in death. Sir J. Elphinstone showed the other day to the House of Commons that nearly one thousand English lives were lost at sea in 1862; and it has been at last found necessary to subject the anchors and chain cables of merchant-vessels to an official test. According to the necessarily imperfect returns from the Manchester Association for the Prevention of Boiler Explosions, seventy-six people were killed and eighty injured last year by the explosions of steam-boilers in England. This death-roll could be yet lengthened by many unrecorded disasters. But the fallen are soon forgotten; the ranks of labour quickly



close up. The poor have no fees for compensation suits. Yet these figures, confessedly incomplete, speak for themselves to tell us that a happy medium between an undue legislative interference on the one hand, and an appalling destruction of life on the other, is one of the wants of the time.

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XVIII.—*On Storing Turnips, Mangold, Potatoes, and Carrots*  
By GEORGE JONAS.

PRIZE ESSAY.

THIS Essay is intended to embody the results of practical experience, derived from the management of about 700 acres of roots, grown annually under my superintendence. The chief points to be observed for ensuring success in storing are, first, to select dry and fine weather for the operation, and never, under any circumstances, to cart or store any which are the least frost-bitten; to cover up and keep them dry when carted, but never so closely covered as to prevent the escape of any slight heat arising from the heaps and clamps when first stored; to be exceedingly watchful in the spring, as soon as vegetation commences, to uncover the top or ridges of the stored roots, so as to allow the escape of any heat arising from their sprouting.

1 The general time for beginning this work is the middle or latter part of October, and it is not generally completed till the latter part of November, or in some mild seasons until the beginning of December. Fine weather not only ensures the safety of the crop, but allows of the roots being laid in larger heaps, and in great measure protects the land from the injury caused by carting.

On heavy lands, ill suited for sheep, the whole of the turnip crop is drawn for stall-feeding; but on light sheep farms, the general and best plan is to remove about one-fourth or one-fifth, according to the crop, taking five rows and leaving fifteen or twenty, or doubling these numbers. By this means the whole of the land is folded regularly, and turnips enough for the cattle are procured without exhausting the land.

The turnips required for immediate consumption in the yards should be drawn off, well cleaned and topped, then carted and stored in houses or sheds about the latter part of October. If the sheds be open, they should be covered with straw to protect them from the frost. All the turnips that are to be consumed in the yards should be carried home and secured before the frost sets in; therefore, where there is not sufficient shed-room, they may be kept very well in large heaps, on the



south side of walls or buildings, care being taken in the latter case that there is troughing to protect the heap from the dripping eaves. The base wall is formed by two rows of hurdles, set about 3 feet apart, the space between them being well stuffed with barley-straw or some short pulse to keep out the frost. The turnips are laid up to the top of the hurdles and piled up against the wall, the heap being covered with a thick coat of straw from the hurdles to the top of the slope.

This winter about 100 loads, carted in fine weather, and laid up against a barn in this way, kept in capital condition, and there was not a bushel of decayed turnips in the whole heap. It is a good plan to put a little straw at the bottom of the heap, to keep the roots from the ground. Another plan is to lay them up in long heaps of a triangular shape, about 8 feet wide at the base and 6 feet high, covering them over first with straw, and then with a slight layer of earth, but leaving the ridge without any earth on.

When stored in either of the above ways, the turnips should be cleaned, and the crown or neck cut off close to the turnip, so as to prevent their sprouting; if not thus treated they will begin to vegetate, which causes them to heat and decay very quickly. They will keep good till the end of February when properly stored. If it is required to keep them till March or April, they should be laid up in heaps from 15 to 20 yards long, about 3 feet high and  $3\frac{1}{2}$  feet wide at the base, tapering to the top, and covered with earth as a protection from the frost: the tops in this case are cut off, but the roots and earth hanging to them left on.

The cleaning the turnips for carting home is done by women, at a cost of 4s. or 5s. per acre, or by a gang of children, having a man to superintend them. For this purpose they use a knife or chopper, with which they remove all the earth from the turnip and cut off the tops, throwing the roots in heaps ready for carting, as they are cleaned. All that are left in heaps in the field at night should be covered up with the leaves, to protect them from the weather.

The cost of filling into carts for carrying home would be about 2s. per acre.

Turnips are stored in a variety of ways for consumption in the field. When they are to be cut for sheep, they should be laid in heaps of about 30 bushels, with a little haulm or straw put on, and over this a covering of earth; a little piece of straw being left uncovered at the top to let any heat escape. All that are intended for use before the end of January should be cleaned and the leaves cut off before they are heaped up; but those for later feeding should be laid in heaps of about 10 or 12 bushels without

being cleaned, as the earth thus left on tends to keep them fresher and in better condition. No straw is then used, a covering of 4 or 5 inches of earth alone being required.

The work of cleaning and throwing into heaps of about 30 bushels ready for covering up is done by women and children, at a cost of from 4s. to 5s. per acre. The covering up with straw or haulm and earthing over will cost about 1s. 6d. per acre. Those that are heaped without being cleaned will cost about 1s. 6d. per acre to pull up and throw in heaps, and about 2s. per acre to cover over with earth.

Another plan of storing turnips is to lay them in a furrow and plough them in. This is done by ploughing out two deep furrows up the centre of eight rows, the two centre rows being first pulled and laid aside; the turnips are then pulled up by two children and handed to a man (who stands between them) to be placed in the furrow tops upwards; another furrow is then turned on to them on each side of the row, covering them up to the necks: 2s. 6d. an acre will be a fair price for pulling and placing in the furrows. Turnips will stand almost any amount of frost when stored in this way, and are much better than those left in the ground, even if they have escaped the frost; besides they do not draw the land.

Another plan is to pack the turnips in round patches, putting three or four loads in each patch. This is done by beginning in the centre to set them up with the tops uppermost, packing them close to each other till the patch is the required size, the leaves and all the soil hanging to the roots being left on; the outside row should be covered up to the neck with earth, and in very severe weather a little straw should be thrown over the top. This plan is best adapted for storing roots on the stubble-lands for spring consumption, so that the turnip-land can be got ready for the barley crop.

#### MANGOLD.

The general time for storing this crop is the latter part of October or the beginning of November, according to the season. If left later they are liable to be injured by the frost.

In taking up the crop the roots should be pulled up—care being taken not to bruise them by kicking them up—the leaves cut or twisted off, and the roots either thrown in heaps or loaded at once into carts. Twisting the leaves off is much better than cutting them off, as the mangold are liable to get injured by the careless use of the knife; if the crown is cut, they very often decay.

Mangold left in the ground will stand a frost, if not very severe, as their leaves protect them; but when they are pulled a very

little frost will injure them, therefore all the heaps left in the field at night should be covered up with the leaves.

They are best stored in long heaps of a triangular shape, about 6 feet wide at the base and 4 feet high. These heaps should receive an even coat of haulm, or straw, about 12 inches thick, and about three or four days afterwards they should have a covering of earth of about 8 or 10 inches thick, taken from a trench made on either side: bunches of straw should be left, about 4 feet apart, sticking out at the top of the ridge to let out the heat. If this precaution is not taken, the roots will often decay from heating.

These heaps, or clamps as they are sometimes called, should be placed in some convenient spot close to the yards, and those that are to be consumed in the field by sheep should be placed on the headland of the field where rye-grass, rye, and tares, or some other spring feed is sown. This will save much labour in carting them a second time.

The wringing the tops off and throwing the roots in heaps ready for carting is sometimes done by day-work with children, having a man to superintend them, at a cost of 4s. 6d. per acre; the filling into carts and clamping will cost from 2s. to 2s. 6d. per acre. When the work is done entirely by men, it may be taken as piece-work at 6s. or 6s. 6d. per acre, according to the crop; this includes pulling and wringing the tops off, and filling into carts. The horse is, in this case, led up the centre of each six rows, so that the wheels will span the two centre rows; three men follow each cart, taking two rows each; one man will clamp (or stack) them as fast as six men can top and fill. The cost of horse-labour will depend upon the distance the roots are carried; one-horse carts should always be used, if possible, as there is no loss of time in changing the trace-horse; boys are generally employed to drive away. The covering with earth, if done by piece-work, costs 10d. to 1s. per rod in length—that is, for digging the earth and covering up; but the cheaper plan is to plough about eight furrows on each side the clamp as deep as possible, turning them to the heap; the furrows are then laid on with a fork or spade, and the loose moulds put on with a shovel to fill up the spaces left by the clods; this will cover each side of the heap within about two feet of the top; they should be left in this state for a few days to let out the heat, then a few more furrows should be ploughed in the bottom of the trenches, and thrown on to complete the covering to the top—bunches of straw or haulm being still left at intervals, as before mentioned, for ventilation.

The heaps should be partially uncovered in March, about two feet of earth being taken off the top, and at intervals of four or



five yards a space four feet wide should be uncovered down to the bottom ; this is done to let out the heat caused about this time by the sprouting of the roots : if this heat cannot escape, they will soon decay. Mangold so stored will keep till July. 467.

### POTATOES.

The middle or end of October is the time for harvesting this crop, except the early sorts, which are begun in the latter part of September, and are taken up as required to supply the demand. As soon as the haulm has withered and begun to decay, the roots may be taken up and placed in houses, being laid in heaps, with straw or boards between them to separate the different sorts.

The first part of the process is, to pull up by hand the whole of the haulm or stalks, and lay them in bundles on the ground ready for burning, or carting into the yards ; any potatoes that come up on the stems may be shaken off and left upon the ground ; by this means, the land is cleared ready for the diggers to follow. Each digger with his fork takes one ridge, women and children act as pickers.

Potatoes are also ploughed out with a double mould-board plough, every other row being done alternately, so as to prevent covering up with the plough. After all the ridges have been ploughed, and the potatoes picked up, a light harrow is passed over the field, to bring any that may be left to the surface, so that they may be found by the pickers.

The work, if done entirely by hand—that is, the mere raising the potatoes with forks, and the women and children picking them up and putting them into sacks or carts—will cost from 21s. to 24s. per acre ; but with the double plough the work is much facilitated, and its cost reduced. The ploughing will come to from 4s. or 5s., and the picking to 6s. or 7s. per acre ; so that the entire cost is reduced by more than half.

The two evils to guard against in storing potatoes (as in other root-crops) are fermentation and premature germination. If the former takes place, the tubers very soon decay ; and if the latter, they not only lose much of their goodness as food, but are weakened for use as sets, since all the shoots have to be broken off before planting. To prevent this, it is of the utmost importance to have the tubers perfectly dry before they are stored for the winter.

Therefore, in the first place, fine weather should be selected for the work ; when taken up, they should be put into sheds or houses, and left for two or three days, then turned over and sorted, small or unsound roots being picked out for the cattle stock. Those selected and reserved for sale should, when pro-



perly dry, be taken to the pits, where they are to be kept for the winter.

These pits or "pies," as they are sometimes called, are made by removing all the top-soil to the depth of about a spit and a-half: some good dry wheat-straw is then laid in the bottom, and at the side, and the potatoes are then put in, and are heaped up above the surface, as high as they will lie, so as to make the sides as nearly upright as possible, the pressure of the earth being thus diminished; a thick coat of well-drawn dry wheat-straw is then laid over them, and on this is placed a complete covering of earth about six inches thick. From two to three tons will be sufficient to put into each pit. On clay-lands the heaps are generally placed on the surface for the sake of dryness.

Some persons prefer storing the potatoes in houses made entirely for the purpose. Doubtless this is the best plan where it can be done, as the store can be looked over at any time during the winter, when the shoots that have begun to sprout may be rubbed off, and decayed tubers may be removed.

#### CARROTS.

Carrots are usually harvested in the beginning of November; dry weather being selected for the work. They are usually lifted by men or women, with a fork or spoon-shaped spade light enough to be used with one hand, so that the other hand may be applied to the tops of the carrots. Great care should be taken to prevent the roots breaking off in the ground: when raised they are laid in rows far enough apart to allow a cart to pass between them, and the tops are cut or twisted off by children. They should be left in the field a few hours to dry before being carted home, where they should be laid in long heaps about  $3\frac{1}{2}$  feet wide at the base and  $2\frac{1}{2}$  feet high, which, like the mangold store, should taper to the top, and receive a covering of straw and earth.

In spring the heaps of unconsumed carrots should be looked over, the decayed roots picked out, and the shoots rubbed from the sound ones; if they are required for late use, the crown should be cut off completely. After being looked over, the roots are heaped as before, but only covered with straw. Carrots are also stored in sheds, and covered over with straw. The cost of taking up carrots varies very much, according to the mode in which they are grown; the old plan was to sow them broadcast, but they are now commonly drilled, and the carrots are readily forked up when in rows.

For a crop sown broadcast the cost of taking up, topping,

and laying in rows, would be from 18s. to 20s., but when drilled about 13s. per acre; the filling into carts is generally done by day-work at a cost of 3s. per acre, the unloading and stacking in heaps at about 1s. per acre. When stored in sheds the cost of stacking would not be so much; covering the heaps with straw and earth will cost about 5d. per rod if the heaps be ploughed round the same as for mangold.

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XIX.—*The Improved Construction of Stables.* By P. H. FRERE.

THE Commission appointed to consider the improvement of our Barracks and Hospitals has this year published a Report on the Ventilation of Cavalry Stables, which contains suggestions that may be profitable to the Agricultural community.

As formerly disregarded, if not wilful neglect, of the sanitary requirements of the horse was, perhaps, displayed in its strongest colours under military routine, so the influence of systematic management in our army may now lead the way in the path of improvement.

The old rule for the construction of cavalry barracks seems to have been that the men should be housed over the horses; the buildings were erected in solid blocks, the longer front being made up of the ends of the several adjacent stables; the party-walls—the roofs, with their ridges and gutters—and also the line of stalls, all ran *transversely* to a width of about 45 feet; so that some eight stalls were placed in a row, of which the two outer alone derived air and light directly from the window placed at either end of each compartment. The rooms above hindered ventilation through the roof, and air-shafts, if adopted at all, offered but an imperfect remedy. The horses generally stood in a double row, heel to heel, with a single path up the centre.

Farm-stables half a century old often exhibit the same principles of construction, roof-ventilation being in them quite neglected, even if the building has only one story.

The defects of this arrangement are clearly indicated by the following recommendations of the Commission:—

1. That the old transverse arrangement of stable be discontinued.
2. That in future all troop-stables be built with open roofs and ridge-ventilation from end to end.
3. That the roofs be partially and sufficiently glazed, to afford plenty of light.
4. That in so far as concerns facility of ventilation and supervision the open-roofed stable, having a central passage 14 feet in

width between the stalls, is preferable to the open-roofed stable with a centre division-wall, and two passages each of half that width.

5. That besides ridge-ventilation and light, each stall should be provided with a swing window over the horse, and a row of perforated bricks should be carried round the stable under the eaves.

6. That each stall should have a supply of fresh air introduced in the space between the stalls, about six inches from the ground, through perforated bricks.

7. That improved impervious paving be introduced.

8. That all drainage within the stable be carried away in shallow impervious open drains by a rapid slope to the outside of the stable. Covered drains and cess-pits within stables or near the stable-walls being discontinued.

In order that these principles of construction may be better understood, the model-plan given on the next page accompanies the Report.

A few remarks, chiefly taken from the body of the Report, will further explain this subject.

Recommendation No. 2. As to the open roof. Since no suggestion is made as to the covering of the roof with slate or otherwise, the question of partially lining or ceiling between the rafters is not touched upon; the Report is in this respect somewhat defective.

No. 3. It is suggested that the light be admitted on the northern side of the ridge.

No. 4. The farmer is often peculiarly circumstanced as to the contour of his buildings, which are designed not only to house certain animals, but to form enclosures for others which run loose in yards; moreover, his team is differently organized from the cavalry *troop*, and the less each set of carters and horses is interfered with the better. In neither respect will the double row of stalls generally suit his purpose. Such an arrangement generally economises walls, but necessitates a more costly, because broader, roof.\*

No. 5. The Report further suggests that an improved air-brick, "with a louver to throw the air upwards," is a desideratum in stable-ventilation for the course placed under the eaves; on the other hand, the air-bricks inserted just above the ground-level should throw the air-current downwards to the floor. Whether these air-bricks be made of iron or of brick-earth, the trade will, no doubt, with a little encouragement readily meet this requirement.

No. 6. It is elsewhere stated that the area of the holes which admit fresh air in the space between the stalls above the floor should be equal to that of two or three ordinary air-bricks.

Side Elevation.

146'-

12'-

8'-

10'-

WALL 6 ft. THICK.

5'-

6'-6"

14'-

33'-

7'-0"

5'-0"

2'-6"

2'-3"

24 STALLS.

Shallow Surface Channel.

LITTER SHED.

PAVED

Surface Channel.

Ground Plan.

Sliding Doors.

12 feet.

Confiners.

Ventilating Cases.

10	6	0	10	0
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Leathered openings  
the whole Length of 2.56

Vertical  
Opening 1.6

12.07

Combinatorial Course  
12.07

J. B. 1847

Section A—B.



No. 7. The question of paving involves the following principles:—

Paving should wear well, not become slippery; be watertight; be easily cleansed.

No. 8. The objection to cess-pits extends to all sewers or covered drains within stables, which are merely cess-pits of another form.

The drains, like the stable floors, should be impervious to moisture. Cobble-stones and paving-stones should never be used for forming stable-gutters; these should be made of smooth material, with as few joints as possible, carefully laid, having a shallow saucer-shaped section, and with as rapid an incline as it is possible to obtain. . . . .

These gutters should discharge into an underground-drain (which should be a drain-pipe), at a distance of at least 12 feet from the stable-wall. As the surface-drains always receive a considerable quantity of dung, besides urine and water, it would be advantageous to provide a trap at the openings of the underground-drain to prevent effluvia returning, and to avoid stoppages.

*To mend old Stables.*—Besides the directions here given for the erection of new buildings, the Report offers suggestions for the improvement of existing stables. Those arranged on the old transverse construction should have shafts for the removal of foul air carried from the ceiling to above the roof. The middle of the length of the stable is the best place for such shafts, although the corners may be more ready of access. “Their conjoint area should be equal to 18 square inches per horse at the least.”

Fresh air may be admitted by openings close to the ceiling

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#### *Explanation of the Plan.*

The plan is that of a stable for 48 horses under a single roof. The interior length of the building is 143 feet 8 inches, and the breadth 33 feet. The height of the side-walls to the spring of the roof is 12 feet, and the total height is 20 feet 6 inches. Each horse will thus have 1605 cubic feet and about 100 superficial feet of space. There is a door opening in halves and two windows at each opposite end, and a door opening in halves on each opposite side. The stalls are of the usual width of 5 feet 6 inches, and there is a central passage 14 feet wide between the opposite stalls.

This stable is ventilated by a louver 16 inches wide carried from end to end of the roof, affording about 4 square feet of ventilating outlet for each horse.

To ensure a continuous movement of the air in the stable at all times, a course of air-bricks is carried round at the eaves; the whole affording a fresh-air inlet of one square foot per horse, and an open space is left under all the doors for the same object. When a larger amount of ventilation is required, it can be afforded by opening a sufficient number of swing windows, of which one is provided for each stall. These windows are 3 feet 3 inches high, by 2 feet 6 inches wide. To ensure a movement of the air near the horse's head when he is lying down, an air-brick is introduced between every two stalls.

at each end of the stable. Each shaft or inlet should be provided with a louver or "spreader" within the stable, to prevent occasional down-draughts. As many air-bricks as possible should be introduced at the ends, close to the ceiling.

To supply air to the horses while lying down, a hollow iron-shaft may be carried all the way across the stable, from outside to outside, under the cribs, so as to fit into the angle made by the transverse wall and the floor. In this shaft holes will be made at the corner of each stall. This arrangement will be available when horses stand in double rows, heel to heel; it may be adjusted also to other plans.

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When it is in contemplation to provide stable accommodation for cart-horses in stalls amounting to 100 square feet superficial and 1600 cubic feet for each horse, the question arises—whether a single step further would not serviceably provide each horse with a box? With judicious management and a moderate supply of straw, the utmost comfort of the horse may thus be combined with the best economy of manure.

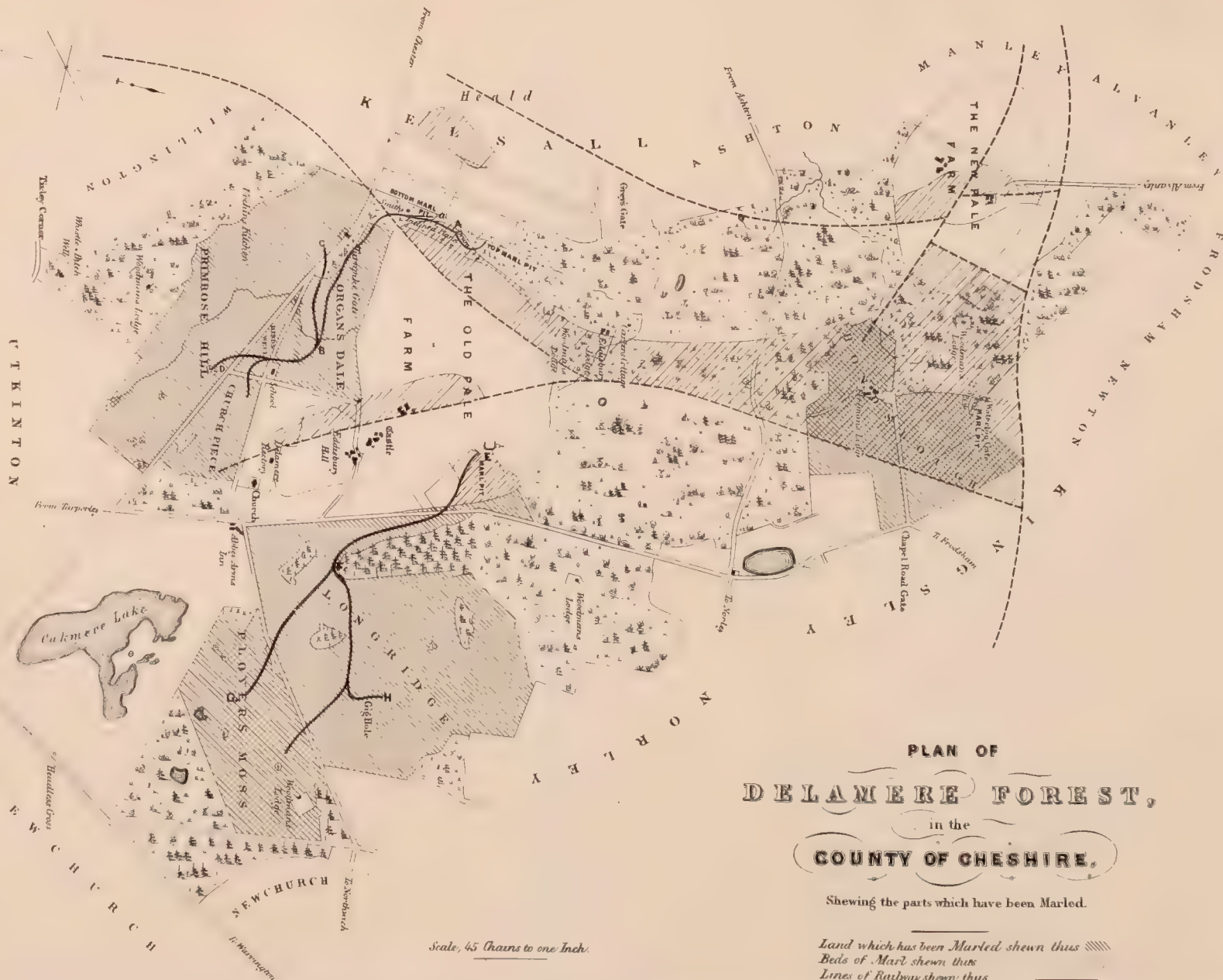
When I last visited Mr. Lawes's farm at Rothamsted, the cart-stabling struck me as almost perfect, though obtained by the conversion of a wide, old, boarded cart-lodge into horse-boxes in a homely style, and at very moderate expense.

These boxes, 10 in number, form a double row, with a raised walk 4 feet 6 inches wide down the centre. A shed at one end acts as a store for hay and straw, and likewise holds the chief part of the harness; the rest is suspended in the stalls. Stout iron rods are used for the sides of the boxes; the wooden pillars, which form two corners of each box and range along the central path on either hand, afford a great stay and support to the old defective roof; each horse has his own rough door opening to the outside, so that he never disturbs his neighbours. The building is detached from the yards, so that one objection connected with stables opening inwards on farm-premises does not here arise; viz., the horses when they go in and out for work or water do not disturb any other stock in the yard. There is louver boarding over each door, and when the horses are at work the doors are set open and the building is thoroughly aired. The litter on the top was clean, the air sweet, without a trace of ammoniacal gases; yet, when Mr. Lawes called for a fork and stirred the bedding from beneath, a moist mass appeared reeking with the richest vapours.

I have seen of late spacious costly halls for stabling cart-nags, where neither the ventilation, the standing, nor the appliances for making and removing manure were half as satisfactory as those of Mr. Lawes.

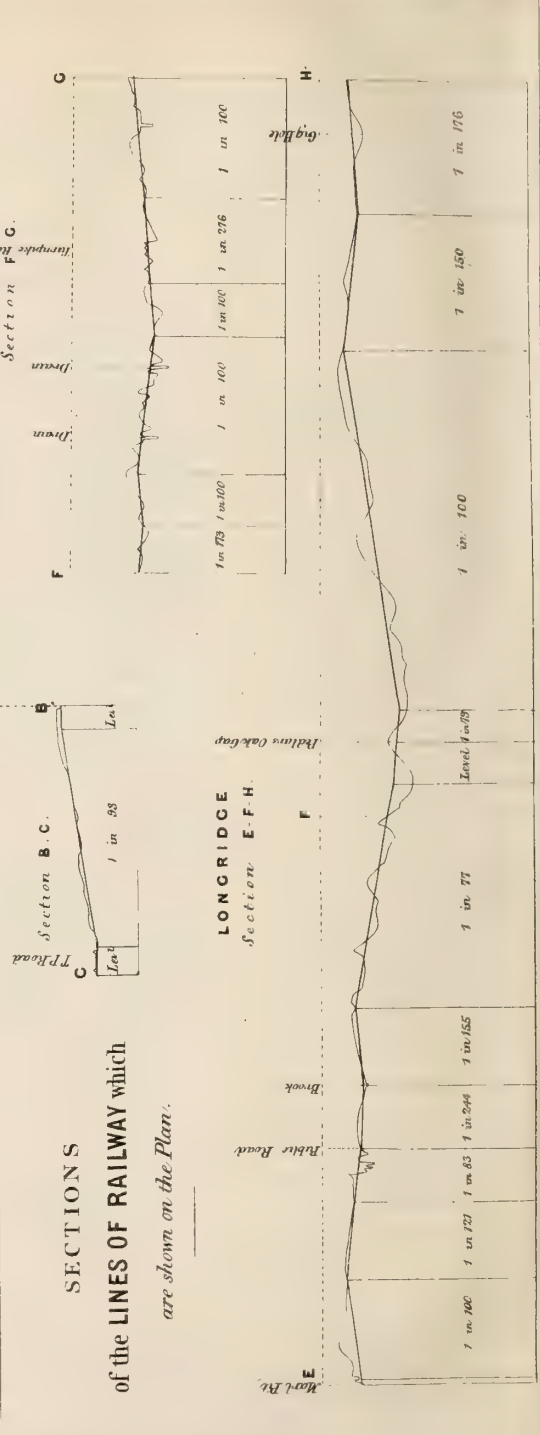
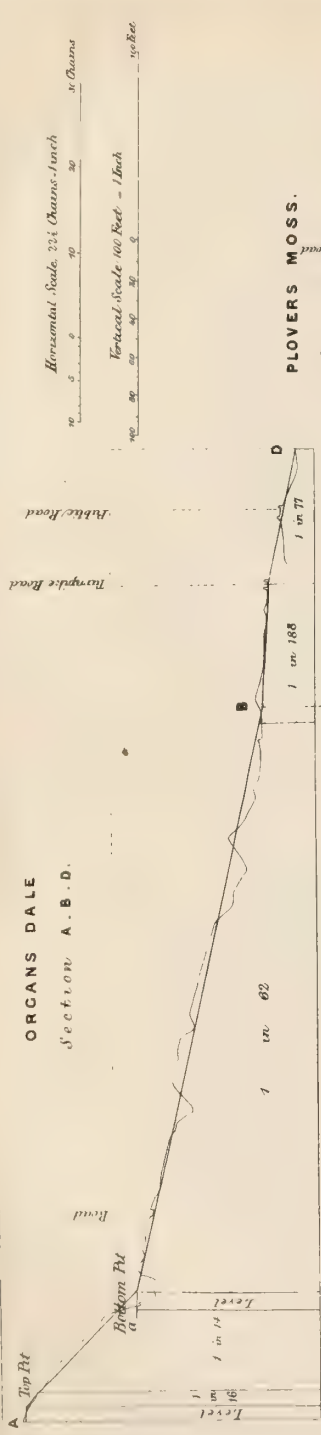
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SECTIONS  
of the LINES OF RAILWAY which  
are shown on the Plan.

XX.—*A Description of the Works for Reclaiming and Marling parts of the late Forest of Delamere, in the County of Cheshire.*

By RICHARD B. GRANTHAM, Civil Engineer and F.G.S.

THIS woodland is situated between the towns of Chester and Northwich, being distant about ten miles from the former and seven miles from the latter. The turnpike-road between the two towns runs through the property.

The estate contains 4023 acres, in the possession of the Crown as woodland, beside Old and New Pale Farms, containing in all 755 acres, which were reclaimed and brought into cultivation at the latter end of last century, under a lease from the Crown.

The entire district belongs geologically to the new red sandstone formation, and the forest is on the white sandstone (Keuper) and red marl strata of that formation.

The following is an extract from the memoir attached to the Ordnance map, which is geologically coloured:—

“On Longley Hill the beds dip east at  $9^{\circ}$ , and in the valley, which is remarkably straight, there is a fault with a slight down-throw on the west, which changes the dip. On the top of the hill at Heald there is a small outlier of red marl shown in some marl-pits, the dip being west at  $4^{\circ}$ . Beyond this the beds roll over and dip towards the base of Eddisbury Hill, bringing in the red marl, which may be seen in some pits close to the fault, which ranges north and south along the western base of the hill. This fault produces a very marked feature, and has a down-throw on the west of about 400 feet.

“Eddisbury Hill reaches an elevation of 583 feet, and from its summit a very fine view may be obtained of the Delamere Hills to the north, and of the wooded plains which extend eastward and northwards from its base. The top of the hill is composed of flags and shales belonging to the highest beds of the water-stories. The dip is east at  $12^{\circ}$ , and the red marl is brought in by a north-west fault, which traverses the centre of the hill west of the camp.

“It should be stated that the greater portion of the Cheshire plain is deeply overspread with drift, which renders the geology very obscure.”\*

The marl lies in detached spots, and in one part forms a long strip stretching towards Honslough, at the northern extremity of the forest.

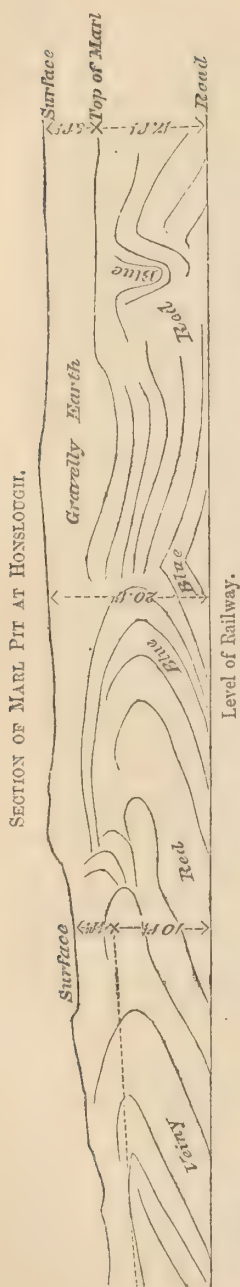
The irregular distorted nature of the beds (as well as the faults) shows how great were the forces by which the disruption was effected.

This irregularity is in some degree an advantage to the estate, as some of the marl beds have thereby been rendered more easy of access.

The surface soil of the estate consists of gravel and sand, separate, and mixed with occasional beds of peat. The crop upon it consisted chiefly of oak, the residue being Scotch fir and

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\* The Marl Beds are shown on the map accompanying this paper by broken hatching. The Faults are shown by strong dotted line (see reference on map).



larch, the whole of which was planted under the following circumstances:—By the Act 52 Geo. III., c. 136, passed in the year 1812, at which date there was a general feeling of alarm at the prospect of the failure in the supply of timber for the navy, the Commissioners of Woods were required to keep this estate (exclusive of the Old and New Pale Farms before referred to) as a nursery for wood and timber only, and for no other purpose whatever. Nearly two-thirds of the estate were planted in pursuance of the directions contained in that Act, but a considerable portion of the young crop did not thrive, and the Commissioners of Woods, in charge of the Royal forests and plantations, came to the conclusion that much of the land might be profitably converted into farms; and in 1856 an Act was obtained to empower the Commissioners to clear the land and to let it upon farming leases.

The improvements already effected upon the Old and New Pale Farms, held from the Crown under lease, were a guide for future action, and the portions of the estate that were least fit for the growth of timber and most suited for the application of marl were selected for clearing, and after careful inquiries had been made as to the best system to be adopted, the Commissioners directed Mr. Clutton to proceed with the reclamation.

The accompanying map shows the extent and limits of the Crown property, both as woodland and in farms.

I now proceed to describe separately the works executed on the three portions of the woodland recently cleared, and let for cultivation.

First. *Honslough*.—The northern part of an allotment of Castle Hill, called Honslough, containing 248 acres, and lying on the marl, was the first taken in hand: the whole was cleared, grubbed, trenched, and marled. This land, like the rest of the estate,



consisted chiefly of light sandy and gravelly soil, with some peat. The surface is tolerably level, except at the south end, where a stream in a low valley traverses it. The marl-pit is at the extreme north part of the land (at Waterloo Gate), as shown on the map. Trial-shafts and borings were made to ascertain the thickness of the earth overlying the marl, technically called "fee" or "rid," which was found to be very variable, as the upper surface of the marl undulated to a greater extent than that of the land above it.

At the first commencement of the operations at Honslough it was deemed advisable that the work of excavating, carrying, and spreading the marl should be performed by contract; the work was consequently advertised, several tenders were received, and an agreement was entered into at the price of  $8\frac{3}{4}d.$  per cube yard, and a commencement was made in February, 1860. When, however, the contractor had brought a limited quantity of rails, waggons, horses, &c., on the land, and had marled about sixty acres, it became apparent that he could not continue the work at that price. The contract was therefore put an end to, and the work was proceeded with under the charge of an engineer and superintendent, by whom it was completed in December, 1860.

The *modus operandi* was this:—The fee was in the first instance carefully removed from the upper surface of the marl, and I may here observe that it was subsequently disposed of by being thrown into the part of the pit from which the marl had been excavated. The marl having been laid bare and opened, rails of light form, fastened upon longitudinal sleepers, were laid into the pit at a low level, so as to arrive at the bottom of the marl bed. The average depth of marl was from 10 to 17 feet; the fee above it varying from 4 feet to 5 feet, or about from a quarter to one-half the depth of the marl. The marl beds were stratified and were very much distorted, as shown by the annexed section, and their colour varied from a dark red to that of a light blue slate:—

The following is an analysis of an average sample of the marl:—

Moisture	..	..	..	..	..	..	..	..	..	1.96
Organic matter and water of combination	..	..	..	..	..	..	..	..	..	2.52
Oxides of iron and alumina	..	..	..	..	..	..	..	..	..	14.21
Carbonate of lime	..	..	..	..	..	..	..	..	..	8.65
Magnesia	..	..	..	..	..	..	..	..	..	1.39
Phosphoric acid	..	..	..	..	..	..	..	..	..	.36
Potash and soda	..	..	..	..	..	..	..	..	..	1.91
Insoluble silicious matter	..	..	..	..	..	..	..	..	..	69.00

The railway was 2 ft. 7 in. gauge, and the waggons, made on the side tipping plan, contained about  $1\frac{1}{3}$  cube yards of marl, and weighed about 1 ton 18 cwt. The waggons upon being

drawn out of the pit by horses were made up into trains and drawn away upon a main or straight road to a certain point from which branch lines diverged: the extreme distance to be traversed was about one mile. These branch lines consisted of rails fastened upon wooden sleepers made into frames about 14 feet in length, which were moved by two men or a horse so as to form parallel lines at such intervals as the prescribed dressing of marl rendered desirable.

The waggons being tipped on either side of the rails, and a load shot down at an interval of 5 yards, it was found that by laying the branch lines 12 yards apart a dressing of about 130 cube yards was applied to each acre. The marling varied in amount from 100 to 180 cube yards, and on the whole an average of 117 cube yards per acre was spread. On steep hill sides a windlass was used, by which the descending full waggons drew up the empty ones.

The total quantity of marl taken out and spread upon the 248 acres was 29,000 cube yards, at a total cost of 1797*l.*, being at the rate of 14*·*87*d.* per cube yard, and of 7*l.* 4*s.* 11*d.* per acre. This estimate includes every expense of marling, except the loss or depreciation of the plant and horses, and the cost of superintendence. The plant in use on Honslough was taken up from the contractor, and consisted of about 1200 yards of rails and planks, 30 waggons, 10 horses, besides barrows, planks, carts, &c. The land, which in its former state was not worth more than 5*s.* per acre, is now formed into one farm, and lets for 1*l.* 10*s.* per acre.

The farm buildings were subsequently constructed, for which, in addition to the above rent, interest is received on all the outlay required above 500*l.*

Second. *Longridge and Plovers Moss*.—It was next determined to clear, trench, and marl certain portions of Longridge and Plovers Moss; but the position and quality of the marl bed, the undulating nature of the ground, the great extent (800 acres) to be reclaimed and the distance to be traversed, required a different system of management. The surface-soil is of the same character as that before described, but peat mosses of varied size, on which Scotch firs are still left growing undisturbed, intervene.

With the view of completing the work in the shortest time and in the most economical manner, all circumstances being taken into consideration, I recommended that a small locomotive of 2 ft. 7 in. gauge should be employed, and the number of waggons increased to sixty. The best line for the railway from the marl pit was selected under the condition that it must be central, and be available for all parts of these lands; its direction and gra-

dients are shown by the plan and section. Stronger rails were procured for the locomotive line than had hitherto been used for the moveable roads, and they were fastened on longitudinal sleepers, consisting of deal planks; the line was formed by cuttings and embankments, so that the engine, with its train of waggons, started at the pit's mouth and ran as far as was convenient to the several points from which moveable rails diverged, over which the waggons were drawn by horses to distribute the loads. The longest distance which the locomotive ran was a mile and half, and the horses took on the waggons a distance of about half a mile further. In some cases the moveable rails had to traverse the sides of steep slopes, or to go up and down sharp inclines for short distances.

When one part was marled, the main road was taken up and laid in another direction. The system, as before practised at Honslough, was adopted of taking out the marl upon the moveable roads and tipping it in heaps, which were afterwards spread.

The engine drew twelve full waggons, weighing, including herself, about 33 tons, up the incline of 1 in 100, at the rate of four to five miles an hour, and took the empty ones back up 1 in 77 at six to eight miles an hour. (See sections E. F. H. and F. G.)

On reference to the plan it will be seen that the marl pit lies at some distance from the principal part of the land to be marled at E. in a valley at the east foot of Eddisbury Hill, and forming part of Old Pale Farm. The marl was of quite a different character from that before described, and had the appearance of dull red clay. It differs from the rock beds of the new red sandstone formation, which afford the marl in general use in the country, and is probably derived from the denudated marl beds and conveyed by water to an ancient valley. In composition it does not materially differ from the rock beds, as the following table will show:—

Moisture .. .. .	1·55
Organic matter and water in combination .. .. .	·85
Lime .. .. .	5·76
Magnesia .. .. .	2·11
Potash and soda calculated as chlorides .. .. .	2·01
Carbonic acid and loss .. .. .	7·71
Insoluble silicious matter .. .. .	63·48
Oxides of iron and alumina and traces of phosphoric acid ..	16·53

When taken out upon the land in lumps and dried by exposure, it laminates like thin slate, and is easily mixed with the soil by ploughing and harrowing. The pit was from 15 to 20 feet deep below the ordinary surface of the land: this depth includes the bearing or fee as well as the bed of the marl, the latter being from 12 to 15 feet in thickness in the centre or deepest part,

thinning out on both sides. The fee was very carefully taken off the surface of the marl and thrown back into the place from whence the marl had been excavated. The waggon roads were laid into the bottom of the marl bed, which rested on sand and on a bed of large water-worn pebbles. The thickness of the fee was moderate and uniform, being about one-fourth to one-fifth of that of the marl.

The work of marling commenced in Longridge and Plovers Moss early in March, 1861, and was completed at the end of March, 1863, a period of exactly twenty-five months. The work proceeded at the average rate of about 32 acres per month; the largest quantity being 63 acres, and the least 18 acres, in one month. 87,228 cubic yards of marl were excavated and conveyed an average lead of two miles, and the quantity spread per acre was at the rate of about 110 cube yards, at a cost of 7890*l.*, being at the rate of 21·70*d.* per cube yard, and of 9*l.* 18*s.* per acre, exclusive of the loss upon the disposal of the plant, and the cost of superintendence.

The following table gives the cost of each portion of the work per cube yard:—

	<i>d.</i>
Removing fee and excavating marl .. .. .	4·89
Spreading marl .. .. .	1·32
Removing materials of, and making railway, laying rails, repairing and removing temporary roads, and tipping waggons .. .. .	3·95
General work at the marl-pits .. .. .	3·66
Carpenters' wages .. .. .	·50
Blacksmiths' wages .. .. .	·44
Feed of horses, horsekeepers and drivers, harness and repairs to ditto .. .. .	4·01
Engine, including driver, cleaners, fuel, oil, &c., and repairs to ditto .. .. .	1·94
Repairing waggons (materials) .. .. .	·43
Carting materials for repairs .. .. .	·23
Foremen, &c. .. .. .	·33
	<hr/>
	21·70

The plant employed on this portion consisted of the locomotive, 11 horses, 60 waggons, 2600 yards of engine rails, 2500 yards of moveable rails, barrows, planks, carts, &c. The repairs and renewals were all executed on the works, and were charged to Marling, as will be seen by the foregoing table. The number of men and boys employed was about seventy.

At the conclusion of the work all the rails, waggons, locomotive, &c., were removed to Organsdale and Primrose Hill allotments, which will be next described.

The whole of the 800 acres in Longridge and Plovers Moss could not have been considered worth more than 5*s.* per



acre in their former state; they are now let in one farm at 32*s.* 6*d.* per acre.

A suitable dwelling-house, cottages, and homestead have been erected, and a new road made, for which interest is paid in addition to the rent.

A second crop is now growing on the land, which, as well as the former crop, has given satisfactory results.

Third. *Organsdale, Primrose Hill, &c. Allotments.*—As the work just described was drawing towards its completion the plant was gradually moved off to Organsdale, Primrose Hill, and other allotments, which had been cleared of timber and grubbed in readiness for the marling, which was commenced by horses in the Organsdale allotment in April, 1863, while the engine was under repair and the locomotive railway being laid down.

The marl bed in this case is situated on the high ground on the west boundary of the property, as shown on the map and on the section A B D; A being the position of the upper pit, and *a* of the lower pit. The marl nearly resembles that of Honslough, and its general position and dip are described in the early part of this paper, in which the geological character of the country is treated of. Its thickness, both in the upper and lower pits, is about 9 feet, but that of the fee, which is composed chiefly of rock, varies considerably. The following is an analysis of the marl:—

Moisture .. .. .	2·22
Organic matter and water of combination .. .. .	·69
Oxides of iron and alumina and traces of phosphoric acid ..	8·10
Lime .. .. .	2·84
Magnesia .. .. .	2·40
Potash and soda calculated as chlorides .. .. .	1·58
Carbonic acid and loss .. .. .	4·33
Insoluble silicious matter .. .. .	77·84

A large proportion of the land in these allotments, of which about 530 acres are in course of being marled, is of a better quality than that before dealt with, therefore a less quantity of marl was considered necessary.

Up to this date (the end of June, 1864) 464 acres have been marled by 45,902 cube yards, being at the rate of 99 cube yards per acre, at a cost of 4732*l.*, at the average rate of 10*l.* 3*s.* 11*d.* per acre, and 24·74*d.* per cube yard. The rate at which the work has proceeded is about 31 acres per month. The same plant has been employed as in Longridge and Plovers Moss, and the same system of main and branch lines has been adopted. By referring to the section A B D, it will be seen that an inclined plane was adopted to bring the waggons from the upper pit to the engine station at the bottom, and by this means five loaded waggons drew up as many empty ones. The waggons from the

lower pit were brought out to the engine station upon the level; when a train of twelve was formed, the engine started with them down a gradient, for nearly a mile, of 1 in 62, up which she returned with as many empty ones at the rate of six to eight miles an hour, and in this manner has frequently taken out from 140 to 150 waggons a day, containing about  $1\frac{1}{3}$  cube yards each. The following table shows the cost of each portion of the work per cube yard:—

	<i>d.</i>
Removing fee and excavating marl .. .. .	7·31
Spreading marl .. .. .	1·35
Removing materials of, and making railway, laying rails, repairing and moving temporary roads, and tipping waggons .. .. .	3·89
General work at the marl-pits .. .. .	3·04
Carpenters' wages .. .. .	·57
Blacksmiths' wages .. .. .	·54
Feed of horses, horsekeepers and drivers, harness, and repairs to ditto .. .. .	5·23
Engine, including driver, cleaners, fuel, oil, &c., and repairs to ditto .. .. .	1·76
Repairing waggons (materials) .. .. .	·14
Carting materials for repairs .. .. .	·59
Foremen, &c. .. .. .	·32
	<hr/>
	24·74

The largest number of acres marled in one month to this time is 48, and the least 19. The latter was the quantity accomplished by horses when they were employed alone to convey the marl to the portions of the land nearest to the pits which were specially reserved for that object.

The last table shows that the average cost per cube yard of marl has increased in these allotments as compared with other places. This increase may be thus explained: the fee being composed chiefly of rock was excavated at a higher rate of payment; it also bore a larger proportion to the marl beneath than before, amounting to 40 per cent.

The slopes and inclinations of the surface of these lands are rather more uniform and less undulating and precipitous than in Longridge, and offered greater facilities for conveying the marl and spreading it.

The land that was selected to be cleared was not worth more than 7*s.* per acre; but the whole has been let at the rate of 33*s.* per acre.

A residence, cottages, and homestead are being erected and roads formed, for all of which interest is to be paid, in addition to the rent.

As much of the land as was available has been cropped with potatoes and oats, which generally promise well.

*General Remarks.*—Under any circumstances the cost of marling land will vary widely, according to the position and extent of the bed of marl and the facilities of transport. When the aid of a tramway is sought, undulations in the surface of the district, whether small or large, will tell heavily on the results obtainable.

Delamere Forest presents less favourable conditions for the work than many other tracts of waste land in the kingdom. There is no great choice of pits, and these are limited in extent and sometimes covered with much useless earth; the state of the labour market in the neighbourhood and the moist climate (for heavy rain interrupts the work) add materially to the cost of getting the marl, whilst the irregularities of the surface create difficulties and increase the wear and tear to an extent which cannot be easily computed.

On the other hand, the proximity of important manufacturing towns creates a large demand for vegetable produce, which gives a special value to warm sandy soils when rendered capable of growing such crops. The items both on the debtor and creditor side of the account are, therefore, unusually large, and we must look to the balance if we would judge of the results.

Even if this be not so considerable as more favoured spots could present, still a good work is done if the area of cultivated land in this kingdom is increased in a manner consistent with sound economy; and, above all, an example is set and, it may be hoped, an impulse is given by the Crown, which private landowners may follow up to greater advantage by the light of the experience already gained.

Each of the three cases described had its own peculiar conditions calling for varied treatment. In Honslough the large proportion of marl to fee—and that fee was easily moved—the level nature of the land, and the shortness of lead, tended to keep down the cost; but the marling proceeded at a slow rate, being all done by horses, and the cost of management continued longer.

In Longridge and Plovers Moss some of these conditions were reversed. The marl pit was nearly a quarter of a mile from the nearest corner of the area, a large proportion of the leads exceeded two miles, and to the north they attained a distance of two and a half miles.

The engine line, though selected and constructed with great care, had still an incline of 1 in 100 for nearly three quarters of a mile; up which the load was to be drawn. Although here the train was at times reduced to eight waggons, the power of the engine was more severely taxed than has since been the case. The horse, or branch lines were likewise carried over very rough and undulating land in almost all parts of the area.

Parts of Plovers Moss were not so rough, but the waggons had to traverse soft peaty land. The engine line had to be laid with cuttings and embankments of some extent, that the higher lands might be reached. If the work of excavation was here comparatively easy, on the other hand it was very difficult to tip this stiff clay out of the waggons, which were frequently pulled over by their load in wet weather.

In spite of all the difficulties, the whole of the 800 acres included in the second farm, were completed in twenty-five months, or at the rate of 32 acres per month, and the farm was made over to the tenant. By these vigorous measures one year at least was gained in rendering the land available for letting. The inspection, without being costly, was very efficient, providing for the careful selection and even distribution of the marl, so that the work was thoroughly well done.

In the Organsdale and Primrose Hill allotments the cost of getting the marl was increased by the thickness of the fee; but the land lay well for conveyance and spreading. Here, as in the last case, a rent accrued the earlier in consequence of the rapidity with which the work was despatched, and there was a corresponding saving of interest on the previous expenditure for grubbing and trenching the land.

I have seen in the neighbourhood some small areas in the course of being marled by horse and cart, and in some instances I have remarked that much earth and fee were mixed with the marl. The existence of old marl pits, such as that at Old Pale Farm, shows that a large quantity of land in this part of Cheshire was formerly reclaimed. None of these pits, however, are of sufficient size to have furnished marl for a large extent of land.

The greater part of the plant, including the rails, sleepers, and nearly all the waggons, will, after having been used on 1600 acres, be serviceable for the same purpose again. With the engine we fortunately never had an accident, and the only repairs done to her were rendered necessary by hard work.

The land nearest the pits was always left to be marled by horses in case the engine was disabled; but I always found the engine could do twice as much work in a given time as the horses, and at about half the cost as shown by the tables.

In the few districts where marl or clay underlies the surface at the depth of one or two yards, it may be raised from the sub-soil and no plant is necessary; but if it lie at any greater depth the clay must be brought from a pit opened at some distance; in that case, rails laid on longitudinal sleepers and engines to draw the waggons are the cheapest and quickest machinery for accomplishing the object in view, particularly if the land is boggy and soft.



When a roadway has been provided with due regard to inclination and direction, the engine-tracks may often be made available afterwards for farm-roads; such has been the result at Delamere in nearly every case where cuttings and embankments have been made for the tramway.

A few remarks may not be inappropriate here upon the several items which make up the average cost per cube yard of marl spread, as shown by the tables.

In comparing the expense of horse labour with that of the engine, as shown in the table, it should not be overlooked that when horses were employed at Delamere they did not, on an average, convey the marl more than one-third of the distance traversed by the locomotive; at the same time it should be stated that the horse-line was occasionally more rugged and uneven than that of the engine. The locomotive in good weather led from 140 to 150 waggons per day. It could have taken a greater number, but that its efficiency was restricted by the number of waggons, namely 60, of which five or six were always under repair. It was not thought expedient to have a larger stock of them, from the uncertainty whether, though still serviceable, they could be disposed of advantageously when the work should be finished.

Another important and interesting question connected with this subject is the duration of the efficiency of the marl. The experience gained by long and extensive practice in Cheshire indicates, that where marling has been properly done, one application has sufficed to furnish an adequate supply of mineral fertilizers, and also to consolidate sandy lands. To quote an instance which has come under our own observation, the Old and New Pale Farms were reclaimed by marling at the latter end of last century, and are still profitable good farms. The same may be said of some thousands of acres elsewhere. There is no doubt but that the marl acted at first for several years, both chemically and mechanically; after a while all traces of it disappeared, but not until by constant cultivation a more productive soil had by degrees been created. The Old Pale Farm has been in part marled a second time.

Mr. H. S. Thompson concludes his excellent paper on 'Agricultural Progress' in the last number of the Journal, by regretting that he had not time to complete his programme by touching on subjects of great interest, among which he alludes to the claying or marling of light lands, and the connection of railways with agriculture, he also states the great difficulty that exists in collecting any authentic statistics relating to agriculture. The writer hopes that the above description of the marling of parts

of Delamere Forest will furnish some information upon a subject that is of growing importance ; and he ventures further to express his hope that Mr. Thompson will, as he promises, carry the matter farther, and point out to scientific men practically connected with agriculture how they may lend their aid, not only by effecting improvements on a large scale, but by systematically placing on record the results of their experience.

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*Supplement to Mr. Grantham's Paper on the Reclaiming part of Delamere Forest.* By P. II. FRERE.

THE account of this important addition to our area of cultivated ground would be incomplete without some outline of the results subsequently obtained in farming this land. To supply this defect, Mr. Leather, the lessee under the Crown, whose acquaintance I made in my hasty visit to this spot, has obligingly furnished me with the following particulars.

Of the newly marled land a large part was at once cropped with potatoes and with turnips, and gave very satisfactory results.

In the year 1862, 100 acres were planted with potatoes, with a dressing of 4 cwts. of Peruvian guano. The crop, though varying from nearly 10 tons to 3 or 4 tons per acre, was good on the whole, and averaged 6 tons per acre, the marketable potatoes realised 4*l.* per ton ; the residue furnished 30 lbs. per day to 32 horses during 6 months. The sales realised in all 1950*l.*

Sixty acres of roots were also sown, of which 6 were swede, the rest white turnips ; the manure supplied was, of bone dust 5 cwts., Peruvian guano 2 cwts., salt 5 cwts. per acre. The crop was satisfactory ; an acre of it, on the average, carried 290 sheep for one week.

In the following season, 1863, the 100 acres which had already borne potatoes were sown with turnips, of which 70 acres were swede, the rest white.

Sixty acres were manured as follows :—bone-dust 7 cwts., salt 7 cwts., Lawson's nitrophosphate 2 cwts. The other 40 acres had bone-dust 5 cwts, salt 5 cwts, nitrophosphate 2 cwts. The crop was very heavy, and fed 1790 sheep from October till they were sold fat in spring (the last going out in June), besides keeping 6 bullocks, and supplying 28 lbs. per day to 32 horses for two months. Of these roots only one-third were consumed on the land whereon they grew, those that were drawn enabled Mr. Leather to fold 200 acres more of land. The sheep received chaff, 1 part hay to 2 of straw ; the entire cost of their artificial food amounted to 11*s.* per head.

Barley and oats followed in 1864, of which the former is estimated at 35 bushels, the latter at 50 bushels per acre. The clover which is sown with this spring corn promises to become a first class crop.

Tempted by the success of his first venture as a potato grower, Mr. Leather was induced in 1863 to set 300 acres. At first all was full of promise, but the rainy autumn season in Cheshire, disease in the tubers, and the state of the markets combined to show the hazardous nature of this branch of agricultural enterprise. The crop itself was large, so large that the storing and the extra sorting necessitated by disease became very costly, and after all the bulk of the crop had to be applied to pig feeding on a very large scale. But these mishaps are apart from the question of fertility and capabilities which we have been considering.

The following is a general outline of the scheme of management which Mr. Leather proposes to himself for his future guidance :—

*Plan for Cropping Delamere Lodge Farm.*

- 125 acres, first year grass, 75 mown for hay.
- 125 „ second year grass, eaten off by hoggets, ewes, or lambs.
- 125 „ third year grass, 75 acres to be ploughed by Hancock's plough, and sown on flat with swedes or turnips as soon as the land can be spared.
- 125 „ corn; 25 acres of this stubble in winter tares.
- 125 „ fallow crops, viz.: 50 acres in potatoes, to be cleared off ground in time for rape or turnips; 50 acres in swedes, and 25 in swedes or turnips, as the tares are consumed.
- 125 „ corn, sown out with grass-seeds and clover.

(N.B.)—The yard-manure to be applied to the corn-stubble of the fallow break, as long dung in autumn, or as short dung in spring.

Mr. Leather intends to keep a large flock of half-bred Cheviot and Leicester ewes—to be put to a strong Lincoln ram—and to fatten the produce at the age of twelve to fifteen months.

The ewes will be put on white turnips in September, and, as they take the ram, be removed on to grass, receiving there an allowance of hay and straw chaff, with a small quantity of rape or cotton cake if required. Before lambing time the turnips will again be stocked, and the supply of cake increased. The lambs from the time of weaning will receive corn or cake in gradually increasing quantities, so as to average in summer  $\frac{1}{4}$  lb., in the autumn  $\frac{1}{2}$ , in the following spring 1 lb. per head.

XXI.—*Statistics of Live Stock and Dead Meat for Consumption in the Metropolis.* By ROBERT HERBERT.

NOTWITHSTANDING that increased supplies of beasts were on sale in the Metropolitan cattle market during the first six months of 1864, and that the imports from abroad were on a liberal scale, the prices of beef, allowing for usual fluctuations, were well supported. The arrivals from Norfolk, Suffolk, &c., showed a slight decrease in number, those of the previous season, having amounted to 62,170 Scots, crosses, and short-horns, against 66,940 head in the corresponding period in 1863; but their quality was remarkably fine. Hence the majority of the beasts realised as much as 4s. 10d. per 8 lbs., and the Scots and crosses carried a full average quantity of internal fat. The losses from disease have, it is understood, been trifling, and our impression is that stock, generally, was never in a more healthy state than at present. From Scotland the supply of beasts was large, viz., 9918 head against 9610 head last year. The supply was, perhaps, of the finest quality ever known. Some very good beasts came to hand from Herefordshire and Devonshire, and sold well. The receipts from Ireland were moderately extensive, and there was an immense influx of each kind of stock from abroad, the total number imported amounting to 139,984 head, or nearly 40,000 more than in the first six months of 1863. This account does not include entries at the various outports. These heavy importations had, however, very little influence upon the trade, owing to the enormous consumption of meat in this country. Be it remarked, however, that at least two-thirds of the foreign beasts came to hand in very poor condition, and were principally purchased for feeding purposes at low rates.

In the early part of the season most breeds of English sheep appeared fully ripe for the butcher; but towards its close their quality fell off considerably, although the demand was in a healthy state. Downs and half-breeds realised fully 5s. per 8 lbs. out of the wool, even with a decline in the value of rough fat to 2s. per 8 lbs. The number of lambs brought forward was only moderate, and there was a decided falling off in their quality: prices, therefore, fluctuated considerably. Very few English calves were brought forward; but the foreign calves were mostly in good condition, and the trade healthy. There was a very large arrival of pigs from Rotterdam and Hamburg; but the prices obtained for them did not exceed 3s. 6d. to 4s. per 8 lbs.

The prospect for the season for beasts from Lincolnshire, Leicestershire, and Northamptonshire, is fully equal to that of former years. The short-horns already received have been very good, and there is quite as much stock in process of fattening for



the London market as at any former period; but the pastures have been very bare of grass. On the continent the supply is increasing, but the stock now sent bears very little comparison with our own breeds. Prime beasts and sheep are, therefore, likely to continue to be dear.

The annexed return shows the total numbers of each kind of stock exhibited in the great Metropolitan market in the first six months:—

*Total Supplies of Stock Exhibited.*

Last half of year.	Beasts.	Cows.	Sheep and Lambs.	Calves.	Pigs.
1861 .. ..	109,812	3005	604,650	6,560	15,952
1862 .. ..	116,735	3054	631,672	8,259	17,407
1863 .. ..	120,045	3005	628,072	10,449	16,435
1864 .. ..	131,694	3014	622,330	9,935	17,679

The aggregate arrivals of beasts during the present and four previous years were derived as follows:—

*District Bullock Arrivals.*

Last half of year.	Northern Districts.	Eastern Districts.	Other parts of England.	Scotland.	Ireland.
1860 .. ..	4,000	68,520	21,420	5033	1,477
1861 .. ..	47,000	64,060	17,700	8712	256
1862 .. ..	400	68,420	29,290	9794	2,545
1863 .. ..	470	66,940	16,330	9610	1,664
1864 .. ..	—	62,170	19,980	9918	2,740

Within the past fifteen years the average prices have varied as follows:—

*Average Prices of Beef and Mutton.*

Per 8 lbs. to sink the Offal.

BEEF.

	1850.	1855.	1860.	1861.	1862.	1863.	1864.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Inferior ..	2 10	3 4	3 6	3 4	3 0	3 4	3 6
Middling ..	3 6	4 4	4 6	4 4	4 0	4 4	4 6
Prime ..	4 2	5 0	5 6	5 0	4 8	5 0	5 0

MUTTON.

	1850.	1855.	1860.	1861.	1862.	1863.	1864.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Inferior ..	3 0	3 6	3 10	3 8	3 6	3 10	3 8
Middling ..	3 6	4 4	5 2	5 0	4 6	4 8	4 6
Prime ..	4 2	5 0	6 2	5 10	5 4	5 6	5 2

The direct imports of foreign stock in the port of London were as follows:—

*Imports in the first Six Months.*

From	Beasts.	Sheep.	Lambs.	Calves.	Pigs.
Amsterdam .. ..	229	55	..	15	..
Antwerp .. ..	441	82	..	793	592
Boulogne .. ..	..	..	..	..	1,646
Bremen .. ..	511	46	..	..	..
Cadiz .. ..	41	..	..	..	..
Calais .. ..	..	70	..	28	928
Corunna .. ..	358	..	..	..	..
Dordt .. ..	585	3,903	1,399	40	44
Dunkirk .. ..	144	947	..	21	2,065
Gibraltar .. ..	134	..	..	..	..
Gluckstadt .. ..	..	..	..	..	33
Hamburg .. ..	2,121	44,816	..	32	3,806
Harlingen .. ..	12,723	10,631	663	872	86
Havre .. ..	..	180	..	..	86
Oporto .. ..	454	..	..	..	..
Ostend .. ..	1,476	5,550	26	1,268	1,900
Rotterdam .. ..	9,328	16,493	749	7,323	3,026
Schwening .. ..	414	310	..	..	..
Vigo .. ..	501	..	..	..	..
Total .. ..	29,460	83,083	2,837	10,392	14,212

In previous years the importations in the first six months into London only were as follows:—

Year.	Beasts.	Sheep and Lambs.	Calves.	Pigs.
1855 .. ..	18,526	19,930	8,872	409
1860 .. ..	17,193	76,415	7,965	2,492
1861 .. ..	22,045	46,674	6,187	4,309
1862 .. ..	11,462	49,332	9,459	883
1863 .. ..	16,701	91,206	11,445	1,229

Immense supplies of meat were on sale in Newgate and Leadenhall, chiefly from Scotland and the north of England. Beef averaged from 3s. to 4s. 4d., mutton 3s. 4d. to 4s. 8d., lamb 5s. 8d. to 6s. 10d., veal 3s. 10d. to 4s. 8d., and pork 3s. 4d. to 5s. per 8 lbs. by the carcase.

Although the imports of foreign and colonial wool during the first six months were on a liberal scale, the demand for English qualities has been active, and prices have had an upward tendency. In this period the aggregate imports into England thus compare with last season:—

	1863.	1864.
	Bales.	Bales.
Colonial .. ..	249,997	283,162
Foreign .. ..	93,891	87,967
Total .. ..	343,888	371,129

Notwithstanding that the woollen trade has continued in a satisfactory state, no advance was realised for any kind of wool at the colonial sales held in the metropolis. The high range in the value of money, the oppressive tariff in America, and the limited inquiry for the continent, had the effect of inducing caution on the part of buyers. Annexed are the current rates paid for home-grown wools:—

							Per Pack of 240 lbs.			
Fleeces :—							£.	s.	£.	s.
South Down hoggetts	..	..	..	..	..	..	24	0	to	25 10
Half-bred hoggetts	..	..	..	..	..	..	29	0	to	30 0
Kent fleeces	..	..	..	..	..	..	26	0	to	28 0
South Down ewes and wethers	..	..	..	..	..	..	24	0	to	26 0
Leicester ditto	..	..	..	..	..	..	24	0	to	26 0
Sorts :—										
Clothing picklock	..	..	..	..	..	..	24	0	to	25 0
Prime and picklock	..	..	..	..	..	..	22	0	to	23 0
Choice	..	..	..	..	..	..	21	0	to	22 0
Super	..	..	..	..	..	..	18	0	to	18 10
Combing :—										
Wether matching	..	..	..	..	..	..	26	0	to	27 10
Picklock	..	..	..	..	..	..	24	0	to	24 10
Common	..	..	..	..	..	..	20	0	to	22 0
Hog matching	..	..	..	..	..	..	29	0	to	30 0
Picklock matching	..	..	..	..	..	..	24	0	to	26 0
Super ditto	..	..	..	..	..	..	20	0	to	22 0

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XXII.—*Experiments with Salt upon Mangolds.* By  
Dr. AUGUSTUS VOELCKER.

THE last number of this Journal contains a Paper of mine, in which are recorded the results of salt experiments upon mangolds grown in 1862 on a stiff calcareous clay. This land is too cold and retentive of moisture for bringing roots to early maturity; the consequence is, that mangolds grown on it frequently do not get fully ripe by the time when the anticipation of frost renders it desirable to take up the crop.

On such land I have much reason to think common salt is of doubtful utility as a fertilizer, even when applied to crops which, like mangolds, are considered to be specially grateful for its application.

Indeed, my own experience is, that salt occasionally does more harm than good, not only to mangolds, but to other crops as well; and I have no hesitation in saying that, in cold summers, even a moderate dressing is injurious to mangolds when the

crop has to be grown on a cold calcareous clay, or on similar stiff soils.

At all events, the results of my experiments in 1862 were not calculated to demonstrate the utility of salt as a manure for mangolds. Knowing, however, how much the efficacy of all fertilizers is affected by the character of the land to which they are applied, I was desirous to try, another season, similar salt-experiments on a soil of diametrically opposite physical characters and chemical composition. A favourable opportunity for the performance of such trials was afforded to me, in 1863, by my friend and pupil, Mr. Kimber, of Tubney Warren, Abingdon, Oxfordshire, who selected one of his light fields for the purpose of trying the effects of quantities of common salt, varying from 1 to 9 cwt. per acre, upon mangolds. I am much indebted to Mr. Kimber for the care and interest which he took in these experiments, and the trouble he bestowed upon them.

The soil of the experimental field in 1862 was a light, almost blowing, hungry sand of great depth. By dint of good cultivation and liberal manuring the surface-soil was enriched with some organic matter and also with lime, as will be seen by the subjoined analyses.

*Composition of Soil and Subsoil of Experimental Mangold-field.*

	Soil taken 6 inches deep.	Subsoil taken at a depth of 2 ft. 6 in.
Moisture (when analyzed) .. .. .	3.02	2.03
Organic matters and water of combination ..	4.19	2.70
Oxides of iron and alumina .. .. .	4.13	3.82
Phosphoric acid .. .. .	traces	traces
Carbonate of lime .. .. .	2.07	.62
Sulphate of lime .. .. .	.35	.59
Magnesia and alkalies .. .. .	.41	.31
Insoluble siliceous matter (chiefly sand) ..	85.83	89.93
	<hr/> 100.00	<hr/> 100.00

Both in the soil and subsoil as will be seen, sand greatly predominates. The experimental field in 1863 in this respect presents a striking contrast to that of the preceding year, for the field upon which salt was tried in 1862 hardly contained any sand, and was very rich in clay and lime.

It will be found on comparison that the subsoil is much poorer in organic matter and in lime than the surface. In both the amount of alkalies (potash and soda) is very trifling, and that of phosphoric acid too small to admit of determination. In one word, the soil is a poor sand, yielding remunerative crops only when liberally manured.

In addition to ordinary farmyard dung, the mangold-crop



grown on this light sandy soil was manured with nitro-phosphate, a sample of which on analysis yielded the following results :—

*Composition of a Sample of Nitro-phosphate used in Mangold Experiments.*

Moisture .. .. .	19.04
*Organic matter and water of combination .. ..	18.61
Bi-phosphates of lime .. .. .	12.78
Equal to bone-earth rendered soluble .. .. .	(19.93)
Insoluble phosphates (bone-earth) .. .. .	9.57
Sulphate of lime .. .. .	33.26
Alkaline salts .. .. .	1.60
Insoluble siliceous matter .. .. .	5.14
	<hr/>
	100.00
*Containing nitrogen .. .. .	.81
Equal to ammonia .. .. .	.98

The manure, it will be observed, is essentially a good super-phosphate, containing a moderate amount of nitrogenous matter.

Half an acre of the mangold-field where the plant was most even was set aside and divided into 10 parts. Each plot was thus 1-20th of an acre. A plot in the centre received no salt; the 9 others were dressed at the rate of from 1 to 9 cwts. of common salt per acre. Eventually another plot of 1-20th acre, adjoining the half-acre of roots under experiment, was added and left without salt. This was done for the purpose of ascertaining how far the produce varied in two portions of the same field treated exactly alike in every respect.

The roots were counted on each plot, and, after cleaning and dressing, accurately weighed.

The following table shows the manner in which the experimental plots were disposed, and gives the produce as obtained by actual weight and calculated per acre, and the increase due to the application of salt.

EXPERIMENTS with SALT upon MANGOLDS, grown on a poor Sandy Soil.

Plots of 1/20 Acre.	Salt applied per Acre.	Number of Roots per Plot.	Produce per Plot.	Produce per Acre.	Increase per Acre over Un-salted Plot, No. 6.
	cwts.		cwts. lbs.	tons. cwts. lbs.	tons. cwts. lbs.
No. 1 ..	Nothing	510	13 8	13 1 48	..
„ 2 ..	7	583	18 58	18 10 40	4 1 88
„ 3 ..	5	626	20 0	20 0 0	5 11 48
„ 4 ..	3	600	16 84	16 15 0	2 6 48
„ 5 ..	1	622	14 108	14 19 32	0 10 80
„ 6 ..	Nothing	615	14 48	14 8 64	..
„ 7 ..	2	602	15 28	15 5 0	0 16 48
„ 8 ..	4	621	15 65	15 11 68	1 3 4
„ 9 ..	6	631	16 33	16 5 100	1 17 36
„ 10 ..	8	616	18 9	18 1 68	3 13 4
„ 11 ..	9	618	16 101	16 18 4	2 9 52

On Plot No. 1, where no salt was used, only 510 roots were grown; whilst on the 2nd unsalted plot (No. 6) 615 mangolds, or 105 more than on No. 1, were raised.

The deficiency of roots on No. 1, when multiplied by 20, so as to obtain the produce per acre, is considerable; and it is due, no doubt, to the difference of the number of roots on the Plots No. 1 and No. 6 that the weight of the mangolds on No. 6 was much heavier than those on No. 1.

In field experiments upon root-crops, not less than 1-20th of an acre should be reserved for each trial; and the number of roots should be counted when they are taken up; for, unless the number of roots on the several pieces agree pretty well with each other, the results of the different experiments are abnormal, and cannot be compared.

With the exception of No. 1, the number of roots on the other plots does not vary very much, though more than I like to see.

On No. 6 (unsalted), the number of roots approaches more nearly to that grown on the other plots, excepting in No. 1 and No. 2. The produce of No. 6, therefore, answers better for comparison than that on No. 1.

Notwithstanding some strange discrepancies in the results of the preceding experiments, it will be observed that common salt has had a favourable effect upon the produce in every instance.

The increase in the weight of roots on No. 2 and No. 3, is indeed, very considerable. As salt is a cheap manure, its use in every instance was most beneficial in an economical point of view.

The unsalted Plot No. 6 passed through the centre of the experimental half-acre. On one side of it, salt, at the rate of 1 cwt. per acre, was applied to Plot No. 5; and on the other side, 2 cwt. of salt on Plot No. 7. This order, it will be seen, was preserved up to No. 8, and we have thus, on the right side of No. 6, plots dressed with salt at the rate of 1, 3, 5, and 7 cwt., and on the left plots manured with 2, 4, 6, and 8 cwts. of salt per acre; to which is added No. 11, with 9 cwts. of salt.

In these trials, 1 cwt. and 2 cwts. of salt per acre did not appear much to affect the produce; whilst a dressing of 3 to 8 cwts. per acre gave large increase in the weight of mangolds.

On poor, sandy soils, it would appear from these experiments that as large a dressing as 9 cwts. of salt per acre may be used with advantage. I do not recommend so large a dose, but simply state that it gave  $2\frac{1}{2}$  tons more clean and dressed mangolds per acre than the unsalted portion of the same field. Probably 4 to 5 cwts. is a sufficient dressing on the lightest sands; and on good sandy loams, and warm, friable turnip-soils 3 cwts. of

salt probably will give a better result upon mangolds than a larger dose.

The reader of this Paper will do well to compare the present results with those given in the last number of the Journal. He will be struck with the difference in the practical effect which salt had upon mangolds in the two sets of experiments.

That salt is often injudiciously applied to the land can hardly be denied; but, at the same time, its utility on light, sandy soils, I think, cannot be gainsaid. At all events, the preceding experiments appear to countenance this view, and to agree well with the experience of many intelligent light-land farmers.

In all field experiments anomalies are frequently observable, which sometimes admit of a reasonable explanation; more generally, however, the experimenter cannot explain why, in apparently similar instances, consistent results should not be produced; he has, however, no choice but to record faithfully his results, and is not at liberty to reject those which do not accord with his anticipations. At the same time, it is very desirable to inquire into every particular which may or may not have an influence on the final result.

I am, therefore, indebted to Mr. Kimber for the following particulars, which, I think, throw some light on the apparent anomaly which will be noticed in the preceding experiment, namely, that on the one side of No. 6 (left unsalted) common salt should have given a better result than on the other.

The following table shows the number and weight of the blighted roots in each experimental plot of 1-20th acre, and gives the average weight of blighted and sound roots.

Plots of $\frac{1}{2}$ Acre.	Salt applied per Acre.	Number of Blighted Roots.	Weight of Blighted Roots.	Average Weight of Sound Roots.	Average Weight of Blighted Roots.
	cwts.		cwts. lbs.	cwts. lbs.	cwts. lbs.
No. 1 ..	Nothing	26	0 48	2 92	1 84
„ 2 ..	7	29	0 80	3 60	2 75
„ 3 ..	5	69	1 65	3 70	2 56
„ 4 ..	3	146	2 83	3 47	2 10
„ 5 ..	1	134	2 68	2 96	1 71
„ 6 ..	Nothing	140	2 1	2 92	1 60
„ 7 ..	2	110	1 93	3 5	1 86
„ 8 ..	4	133	2 65	2 59	2 17
„ 9 ..	6	121	2 33	3 7	2 12
„ 10 ..	8	130	2 96	3 50	2 46
„ 11 ..	9	172	3 73	3 32	2 37

It will be seen that the number of blighted roots was very much larger on Plot 11 than on any other; and as the blighted roots weighed much less than an equal number of sound ones,

the produce of No. 11 was not nearly so heavy as it would otherwise have been.

Again, it will be noticed that on Plots 1, 2, and 3, there were not so many blighted roots as on the rest of the plots; and on Plot 3, where 5 cwts. of salt were used, a better result was obtained than on Plot 9, dressed with 6 cwts. of salt.

It is true on Plot No. 1 the number of blighted roots was small, and yet the roots weighed less than on No. 6, the second unsalted plot; but it must be borne in mind that the total number of roots on No. 1 was less by 105 than on No. 6. The deficiency of plants on No. 1 fully explains the difference in the weight of the produce on No. 1 and No. 2.

Notwithstanding these disturbing influences, which seldom can be avoided in field experiments, but which it is well clearly to recognise, the general tenor of all the experiments is, that salt had a very beneficial effect upon the crop.

In conclusion, I may mention that on 6 experimental plots the weight of leaves was carefully ascertained, and found as follows:—

Weight of Leaves on <sup>1</sup> / <sub>20</sub> Acre.									
								Cwts.	lbs.
Plot No. 1.	Nothing	..	..	..	..	..	..	5	93
„	2. Salt at the rate of 7 cwts. per acre	..	..	..	..	..	..	8	1
„	3.	..	5	..	..	..	..	7	41
„	4.	..	3	..	..	..	..	7	2
„	5.	..	1	..	..	..	..	5	80
„	6. Nothing	..	..	..	..	..	..	5	20

It appears clearly from these experiments that common salt had a very marked influence in promoting the development of leaves. On light, sandy soils mangolds are liable to pass too rapidly through all the stages of their growth,—an evil which results in a poor crop.

Common salt, if I am not mistaken, checks this tendency in a great measure, and, by keeping the tops of mangolds in a healthy growing condition, contributes ultimately to a larger produce of roots on light land. It is hardly necessary for me to say that a healthy and abundant development of leaves is essential to the formation of good roots, for it is through the medium of the tops that the latter assimilate organic food and gain in substance.

12, *Hanover Square, London, July, 1864.*



XXIII.—*General Report on the Newcastle Meeting.*

By J. COLEMAN.

THE Newcastle Meeting of 1864, notwithstanding some gloomy anticipations, has proved a great success; and as this was the first occasion on which the Royal Agricultural Society has paid a second visit to the same town, the authorities may be emboldened by the result of this experiment to follow the same plan on future occasions should circumstances justify such a proceeding. One special advantage arose from this arrangement, viz., that this Meeting afforded a means of comparison with that of 1846, and thus indicated the progress that has taken place in the interval.

The chief interest of the Meeting centres in the Implement trials, and especially in those relating to Steam Cultivation, which, under the fostering influence of the Society, has been developed from the regions of theory to the sober reality of economical practice. It is considered that steam power has now so far established its character that, considering the serious outlay involved in such contests, periodical trials might henceforth be advantageously substituted for annual competition. With this view the Society was desirous that the Newcastle experiments should be more comprehensive than those of previous years, and thus afford as it were a landmark and standard for comparison in the history of this great invention. The exertions of the Local Committee, and especially of Mr. Jacob Wilson and his colleague, Mr. Browell, who particularly devoted themselves to the furtherance of this object, were most praiseworthy. In selecting for the inspection of the Visiting Committee one of the finest of trial-grounds, in a district where such selection must have been extremely difficult, and also in advocating an increased grant of 200*l.*, in order to meet the very liberal offer of a similar sum made by Mr. Fowler, the Local Committee rendered important service: indeed, the successful character of the entire show was in no small degree attributable to the hearty co-operation afforded by the Local Committee and the authorities of Newcastle generally. With such an example before them, others were encouraged to zealous activity, and Stewards, Judges, and Exhibitors seemed determined to work together with a will. The Senior Steward of Implements, Mr. Torr, with his colleagues the Hon. A. Vernon and Lord Cathcart, were most unwearied in their exertions, and the Judges must have felt it a pleasure and privilege to act under such thoroughly painstaking and practical leaders. The efforts of the head officials may, however, be rendered comparatively ineffectual if those to whom the details are

entrusted prove either inefficient or lukewarm. The Society was fortunate in having secured the services of such energetic Assistant-Stewards as Mr. Christopher Stephenson and Mr. Garbutt, to carry out the directions of Mr. Elphick, the experienced Manager of the Steam-Ploughing Department. Mr. Garbutt deserves especial notice for the great pains he took to provide horses for the various trials; the splendid teams which were the admiration of the spectators, were procured and arranged by him. Neither should the exertions of the foremen be overlooked. Mr. Coxon, who had charge of the Show-yard, was most prompt in forwarding implements to the trial-grounds. Mr. Moore, foreman of the Steam-ploughing, made excellent arrangement for victualling these voracious consumers. Mr. Gibson, foreman of Horse-ploughs, and Mr. Rogerson, foreman of Cultivators, &c., were equally efficient in their several departments.

The Implement-makers had an opportunity of showing their good-will in a manner which was fully appreciated by the Stewards. The Society were under a promise to complete the cultivation of Mr. Dod's stubble-field reserved for the trial of *Steam Cultivators* in Class I., and Mr. Jamieson's field in which the preliminary trials took place, and the tenants were naturally very anxious that this should be done, as from the dry hard character of the land, which in places had been much trodden, horse-cultivation would have been very difficult, and comparatively inefficient. After the trials were concluded, a considerable area remained unmoved, and the exhibitors, at much inconvenience, divided it amongst them and completed the work.

The police arrangements were excellent, and the success of the trials was in many instances secured by the assistance of the fine body of men under Mr. Wookey, whose courtesy and good temper under trying circumstances was very noticeable.

The accommodation afforded by the North-Eastern Railway to enable live stock, implements, and visitors, to reach and leave the Show was most satisfactory. A siding and temporary station were constructed at Benton, close to the trial grounds, by which implements were delivered with great despatch, and the public were enabled to reach the scene of operations in the most comfortable manner. There was no line, as at Worcester, to the Show-yard; nevertheless the carrying arrangements to and from the station were so good that stock, implements, and the public, were better provided for than on most former occasions. We are very pleased to hear on all sides the most satisfactory accounts as to the transfer of stock from the Show. Last year there were sad complaints. Many of the Shropshire sheep, for example, did not reach Shrewsbury until Monday and Tuesday following the Show, although the distance was so inconsiderable, whereas

we know that on this occasion they were all home on the Saturday night. The best thanks of the Society were very properly presented to the North-Eastern Directors for the great facilities they afforded; not the least of which was the omnibus service provided, which was an immense accommodation to the public.

And lastly, the Society beg most gratefully to acknowledge the hospitality of the Mayor, Sheriff, and Corporation of Newcastle. It would be invidious to draw any comparisons, especially as the Society are generally so kindly treated wherever they go; but this they can say, that those who were fortunate enough to profit by the kindness of the authorities of Newcastle, will bear away with them a very pleasant recollection of the Royal Agricultural Society's Meeting at Newcastle-upon-Tyne.

We may further express a hope that this visit of our Society, and its efforts to manifest the efficiency of steam-culture, may leave some permanent impress on the agriculture of the North-East. The level plains of tenacious soil which lie both north and south of Newcastle, especially call for the action of steam wherever the plough or cultivator is set to work, and however much the present state of our general markets may favour an increase of pasturage in a comparatively moist climate, still the collieries of this district demand supplies both for man and horse, which must in part be provided near at hand. The steam-horse is at least as much wanted here on the surface of the land, as the quadruped is indispensable in the pit.

The Reports of the various Judges which follow have been prepared for the press with as much despatch as was compatible with a careful verification and revision of the important tables attached to some of them.

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STEAM cultivation having become a subject of national importance, the Society decided upon making their last annual trial a much more extensive and complete test than had been possible at any previous Meeting. Accordingly they placed at the disposal of the Judges upwards of 150 acres of land, partly clover-ley and partly stubble from last year's crop. The fields were level, of good rectangular shape, sufficiently large, and, though in three occupations, adjacent one to the other; being all in the parish of Long Benton, about four miles from Newcastle. The soil was remarkably uniform throughout, consisting of a deep strong loam, generally free from stones, sufficiently stiff to afford an excellent test of the capabilities of the different inventions for ordinary work. Any terms we may employ to describe the soil must necessarily be so indefinite, that a suggestion of one of the

Stewards\* that a mechanical analysis might be made of fair samples of soils from each plot, deserves the consideration of the Society. Such a test would be valuable not only as a means of information to the public, but as a point to be considered by the Judges in making their awards.

In addition to the prizes assigned to two classes of cultivators last year at Worcester, the list of this year included prizes for implements, anchors, porters, and windlasses, and was arranged as follows :—

CLASS I.										£
The best application of Steam Power for the Cultivation of the Soil .. .. .										100
Second Prize .. .. .										50
CLASS II.										
The best application of Steam Power adapted for small Occupations .. .. .										50
Second Prize .. .. .										25
CLASS III.										
For Ploughs adapted to Steam Power .. .. .										30
CLASS IV.										
For Cultivators adapted to Steam Power .. .. .										30
CLASS V.										
For Harrows .. .. .										20
CLASS VI.										
For Windlasses, and application of Power thereto .. .. .										30
CLASS VII.										
For Anchors .. .. .										20
CLASS VIII.										
For Rope Porters .. .. .										15
Total .. .. .										£370

At Worcester a *Gold Medal*, and prizes amounting to 100*l.* were offered.

#### *Report of the Judges of Steam Cultivation at Newcastle.*

The great increase in the amount and variety of the prize-list naturally attracted numerous competitors. The work commenced on the afternoon of Tuesday, July 12th, in a stubble-field of Mr. Jamieson's, in which all the machinery entered for competition was collected. Plots of about 1 acre each

\* The Hon. A. Vernon.



were marked out, lots drawn, and an opportunity afforded for a preliminary trial, in order that those in charge of the machines might see that everything was in working order, and that any radically defective apparatus might at once be scratched from further competition. The advantage of this plan was again evident, two exhibitors, Messrs. Richardson of Linsey Works, Lincolnshire, with a new Steam Engine, invented by G. W. Darley, and Fowler's Anchor Windlass, &c., and Mr. Collinson Hall, with two 6-horse engines of E. R. and F. Turner, of Ipswich, fitted with his polygonal drum, and intended to haul the steel-link rope, did not again compete. The novelty in Mr. Richardson's engine consists in the boiler being constructed of steel plates, so as to combine strength with lightness (his 10-horse engine weighing only 3 tons), and in the use of Allen's Patent Cylinders, so constructed as to economise fuel by the complete expansion of the steam. This is accomplished without any separate expansion-valve, the cylinders being provided with an internal trunk. We had no opportunity of judging of the merits of this engine, as the attendants, for reasons unexplained, never had it ready for trial. The engines of Messrs. Turner, though too small for stiff work, are of ingenious construction, and particularly commendable for the simple manner in which Mr. Hall's drum is detached. This is accomplished by removing a pin, when the whole of the windlass can be lowered, and the engine is ready for ordinary farm work. There are other points in which these pony engines are deserving of notice. Locomotion is effected by having two speeds for the pitch-chain, which drive one or both hind wheels. The small travelling-wheels in front can, by means of a worm-wheel and steering-rod, be locked by the driver at a right angle; the engine can thus be turned in little more than its own length. The weight of each engine complete is 4 tons; the price, with the drum attached, 325*l*. As far as we could ascertain, no great alteration has been made in Mr. Hall's invention since the Worcester meeting. The link-chain, which forms the chief feature of his system, is constructed in 18-inch lengths of half inch steel rod, connected by pairs of plates 6 inches long, held together by rivets. Its weight is more than double that of the ordinary wire rope. By some error of construction, the drums were not cast true, and varied 3-sixteenths of an inch; consequently the projections, instead of receiving the plates, came in contact with the rods, and were broken in consequence. This accident was repaired, and although Mr. Hall withdrew from competition, his tackle being evidently in an unmatured state, we had an opportunity of seeing the apparatus at work for a short time on Friday. There appeared great friction between the angular surface of the drum projections and the plates of the link-chain; had the edges been rounded off, this would have been avoided, and the rope would have left the drum without that clinging tendency which must have increased the draft. The anchor differs from Fowler's, in not entering the ground at all; its four rather small wheels travelling on lengths of angle iron, kept in place by iron struts driven into the ground. These rails are easily taken up when clear of the anchor, and relaid in front. The question is whether the struts are capable of resisting the strain when the work is severe. This anchor is commendable for its simplicity and the ease with which it can be moved from field to field. The friction on the joints of the rope, and especially the rivets, must be very great, and we fear breakages would be frequent, from the rope not properly lapping over the projections on the drums. This would inevitably happen should any of the rods become bent, which might easily occur. The system does not embrace porters, and it would have been interesting, had time allowed, to have tested the draft of this rope dragging on the surface, against the wire rope properly "porterred." We were much impressed with the amiability and good temper exhibited by Mr. Hall under his trying disappointment. Whilst these preliminary trials were in progress, the judges were employed in arranging the fields for the

different trials, and in giving directions to the surveyor for the measurement of the lots. Much valuable time during the earlier part of the trials was thus consumed; and the judges would respectfully suggest that in future it would be desirable that the visiting Committee be empowered to decide upon the size of the plots, and arrange for their being measured and marked out, so that the judges would merely decide as to the sites most suitable for the various trials.

As three of the fields were clover ley, it was decided to test the capabilities of competitors in Classes I. and II., for both ploughing and cultivating, without, however, disqualifying any merely cultivating apparatus from inability to plough.

#### CLASS I.

On Wednesday, July 13th, the real work commenced with Class I., ploughing clover ley, 7 inches deep. Five competitors appeared, but as Messrs. Stevens, and Garrett and Sons employed the same power (Savory's double engines), the trial for the latter firm was necessarily deferred until the following day. The first three entries occupied a field adjoining the scene of Tuesday's operations, Messrs. Stevens and Garrett and Sons being placed side by side in a ground of 14 acres on the other side of the road.

The following Table will explain the method of trial adopted, and it will be seen that some new tests were introduced. The time occupied in getting up steam, and in arranging the tackle for work after reaching the field, was accurately noted; and it may be as well to remark here, that in all cases the work was entirely performed by the regular staff belonging to each system, extraneous assistance being forbidden. The entry of fuel includes all that was employed from the time of lighting the fires until the work was completed. In arriving at the last column, total cost per acre, the same calculations as to wear and tear and interest on capital were adopted as at Worcester. Not that such figures are absolutely correct. The great speed at which machinery is often driven at such trials causes increased wear and tear; and probably, if we doubled this item, we should be nearer the mark. The reader can make his own calculations; by adhering to the same data comparisons are rendered easy. The labour-column will be found to vary slightly from the same figures at Worcester. The cost of the water-cart and lad, taken at 4s. a day, is included; also a charge for oil, varying from 1s. to 1s. 6d. a day, according as the system requires one or two engines.

Plots 1 and 2 fell to John Fowler, who occupied Lot 1 with his 14-horse engine and anchor, in precisely the same manner as at Worcester. The four-furrow balance-plough, with slack gear, was used on both plots. The speed was here very moderate; and it was evident that Mr. Fowler was specially desirous of showing good ploughing. The engine was driven with great steadiness, and the work was excellent; indeed, it would have borne comparison with much of the horse-ploughing which took place in an adjacent field. From close observation during these trials we are convinced that good ploughing is impossible at a speed exceeding  $2\frac{1}{2}$  miles per hour. If driven faster, the implement, whatever its construction, becomes unsteady in its movements, either jumps out or draws into the soil, according to the amount of resistance, and the furrow is left in a broken, uneven condition.

Steam does not shine as a ploughing-power. Fortunately it is not often that a complete inversion of the soil is necessary or desirable. Cultivation, digging, or smashing, will generally prove far more beneficial. All Mr. Fowler's implements are on the balance or equipoise principle; whilst there is great merit in this arrangement there is one disadvantage which was noticeable throughout the trials. This principle enables you readily to lift the frame out of work, or to reverse its action, but tends to prevent the ploughs from at once entering

CLASS I.—TABLE 1. COMPETITION OF STEAM PLOUGHS, working 7 Inches deep.

Names.	Number in Catalogue.	Price.	Working Pressure of Steam in lbs.	Nominal Horse-power.	Time required to get up Steam.		Time required to set down Tackle.	Work- ing- time.	Total Fuel consumed	Cost of Labour and Oil per Day.	Work done.			Number of Acres per Day of 10 Hours.	Cost of Coal per Acre, 1s. a cwt.	Wear and Tear and Interest on Capital per Day.		Total Cost per Acre.	
					H.	M.					H.	M.	s.			d.	s.		d.
1. Fowler ..	{1539 and 1544}	875	100	14	1	19	40	5	29	6 0 25	16 0	3	1	2	5.94	1 10.8	15	3.7	7 2
2. Fowler ..	{1540 and 1545}	1066	90	2 engines, 7-horse power each.	{0 50}		12	5	28	7 3 25	18 0	4	2	36	8.64	1 8.3	18	7.8	5 11.1
3. Savory ..	{2284 1609 2286}	785	100	12	0	50	47	4	58	8 3 25	16 0	3	0	27	6.38	2 9.9	13	8.8	7 5.5
4. Steevens	{1316 and 1310}	1160	90	2 engines, 12-horse power each.	{0 56}		6	5	16	13 0 20	17 6	5	0	3	9.53	2.7.5	20	3.6	6 7
5. Garrett ..	{1593 1594 1609}	1175	90	Same power as No. 4.	{0 56}		6	5	33	13 0 20	17 6	4	3	16	8.69	2 8.6	20	6.2	7 1.1

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N.B.—The same figures are adopted for wear and tear and interest as in the Worcester Report, viz. 12½ per cent. for wear and tear, and 5 per cent. for interest divided over 200 days. Oil is charged 1s. a day for single engines, and 1s. 6d. a day in the case of double engines, and is included in the labour column.

their work to the full depth; consequently we find that the anchor lad is frequently called upon to add his weight; still more headland is left unploughed, or irregularly ploughed out than by some other implements. As soon as the slack drums tighten the rope the pressure of the tail-rope helps to keep the plough to its work. But if the system has this objection, which we think cannot be denied, it has the merit of *flexibility*, if we may use the term to express the capacity of the implement to adapt itself to irregularities of surface. This may in some measure be attributed to the influence of larger wheels in steadying the draft. Thus, if worked across, ridge and furrow, it will be found that the balance-plough moves more soil through the low ground than any other implement yet invented. The cost for labour, &c., was as follows:—

					s.	d.
1 engineer	..	..	..	..	3	6 a day.
1 ploughman	..	..	..	..	3	0 "
1 anchor-lad	..	..	..	..	2	0 "
2 porter-boys, 1s. 3d.	..	..	..	..	2	6 "
Water-cart and lad	..	..	..	..	4	0 "
Oil	..	..	..	..	1	0 "
Total .. ..					16	0

When the Judges stopped work at 6 P.M. a considerable portion of the plot, originally about 5 acres, was unfinished. In all cases the land actually ploughed was measured after the work was over, the shortest length being taken in each case, as the headlands would have to be ploughed up to this point.

"On Lot 2," Fowler worked two seven-horse single-cylinder engines, acting simultaneously on opposite headlands. The engines are fitted with clip-drums, reversing gear, &c., precisely similar to those attached to his ordinary engine. "*This arrangement of power was the chief novelty of the Show.*" At Worcester double engines were first exhibited alternately in action. It was suggested that a great improvement would result if the engines could be made to work together. This was then considered impracticable; and yet in one short year we have the idea matured. A great step has been taken in the history of steam-cultivation, which may fairly be claimed as the result of that prize system which has been in some quarters so rashly and sweepingly condemned.

And how has this been brought about? By a simple and apparently insignificant alteration in details: formerly the joints which connect the different lengths of rope could not travel round the clip-drum, the friction-pulleys being fixed in a certain position would cause an obstruction and consequent fracture; the 400-yard rope worked round the clip-drum; the joints travelled round the anchor sheave; and the length of furrow could not exceed about 350 yards. These pulleys are now hung upon an upright axis, and have a free motion, which allows them to give way when a joint passes. They are brought back to their position by the action of an indian-rubber spring which connects them together, and which is strong enough to keep the pulleys properly pressing on the rope. This arrangement works admirably; and during the two days' trials to which these engines were subjected we never found that the rope exhibited any tendency to slip, so perfect was the grip of the clip-drum.

The pace was here considerably faster than on Plot 1, Fowler evidently being desirous of showing economy of cost rather than excellence of work. The furrow was consequently more broken and irregular, but still we considered the work creditable. The engines worked smoothly, and, so far as we could ascertain, appeared to bear an equal share of work in either direction. We would direct attention to the particulars of getting up steam—nearly half an



hour less than the 14-horse engine—to the time required to arrange the tackle in the field, which was carried without the assistance of horses, and likewise to the fuel consumed. The engines were masters of their work; and, acting in combination, appeared to possess more power than the large engine and anchor; but no tests were employed to determine this point. The advantages of this system appear to be: that horses are not required to move tackle; that there is a saving of time in setting down, taking up, and removing from field to field; that the two small engines are both available for ordinary farm-work, such as thrashing, driving, barn-work, &c.; and what is most important, that, in the event of an *accident to one engine*, the work need not be stopped, as by the aid of an anchor the single engine could still proceed with the work, slowly, it may be, but still making some progress, at, perhaps, a critical time, when total suspension would be disastrous. Nay, we do not see why on very large occupations, or for purposes of hiring out, two anchors and extra rope might not be provided, so that in light work, such as scarifying stubbles after harvest, or crossing fallows in spring, two sets could be employed, and thus an immense amount of work accomplished. This adaptability to varying circumstances must always be considered a point of importance. The cost of labour, &c., is as follows:—

					s.	d.	
2 engineers	..	..	..	..	7	0	a day.
1 ploughman	..	..	..	..	3	0	"
2 porter-boys	..	..	..	..	2	6	"
Water-cart and boy	..	..	..	..	4	0	"
Oil	..	..	..	..	1	6	"
Total					<hr/>		
					18	0	

Plot 3 was occupied by Messrs. Savory and Son, of Gloucester, who worked a 12-horse Double Cylinder Engine, furnished with two winding-drums, travelling round the boiler, and acting precisely on the same principle as the windlass exhibited by Messrs. Howard, only attached to and forming part of the engine: they worked Howard's Four-furrow Plough and Fowler's Anchor. Not being provided with the required length of rope (1200 yards) they were unable to plough the whole length of the furrow. Owing to frequent stoppages to adjust the plough the work was slow, and the consumption of fuel greater than it should have been. The quality of the work was good, and second to Plot No. 1.

This Engine can be used with either self-moving anchor or with fixed anchors on the round-about system, and is well adapted for colliery work, &c. The windlasses are thrown in and out of gear by a lever on the tender, which acts through a connecting-rod upon spur-wheels, throwing one into gear and the reverse one out. Cam-wheels regulate the guide-pulleys, which work from right to left, coiling the rope on the somewhat narrow drums with great regularity. Considerable power, however, appears to be consumed in this arrangement, and we noticed that the engine was not so steady or smooth in its motions as their double engines. For thrashing, a cross shaft is driven through the smoke-box from the fly-wheel. In case of stoppage a break is used to prevent slack rope being thrown off. An arrangement of this sort on the double engines might be useful. The cylinders are placed above and below the boiler, and occupy a position nearly in the centre of the engine. Altogether this apparatus has considerable merit. The particulars of labour being identical with Lot 1, are not repeated.

Lot 4, in another field, fell to Mr. Steevens, who employed Garrett and Son's Double Engines (Savory's patent), working his Four-furrow Plough

and Cultivator combined. It is only fair to state that the surface in this field was somewhat trodden, and in places the furrows had to be crossed by the implement, disadvantages which were duly noticed by the Judges. Just as at Worcester, the implement was driven too fast to allow of good work. The furrow was most irregular and broken, and in places it was difficult to decide from the appearance of the surface whether it was ploughing or cultivating. The depth was unequal, and altogether indifferent work was made. Mr. Steevens has considerably strengthened and improved his implement since Worcester; the principle is the same, but the arrangements for steering and reversing the lower frames, which carry the working parts of the plough are by an ingenious arrangement made to work in each other—that is, the connecting-rod by which the frames are raised passes through the steering-rod, which is hollow. This implement was so briefly alluded to in the Worcester Report that we think a short description may be acceptable. It is perfectly rectangular in outline, and of equal height from back to front; consisting of two frames, of which the upper one is fixed, having small wheels at either end travelling on the hard surface, which tend to keep it rigid; the under frame is divided into two portions, each being independent. The cultivating implements are fixed to the lower frames, and are elevated and depressed by means of a rack and pinion. The man's seat is part of the upper frame; so the implement when entering the soil takes its depth according to the position to which it is regulated by the rack and pinion, uninfluenced by his weight. The implement enters the ground more readily than the balance plough, and on a perfectly level surface and mild soil would undoubtedly make good work; where the surface is irregular and hard, the depth is uneven, and when ridge and furrow were crossed the work was very bad, little or no soil being moved through the low ground. The rapidity with which the double engines got to work was very remarkable, only six minutes being occupied in putting down the tackle, and this without any employment of horse-power. These tests were not applied to the trial No. 5 on the following day; but since the actual coal consumed by Messrs. Garrett and Son whilst in work was 11 cwt. 1 qr. 14 lbs., it was assumed that the difference between this and 13 cwt. 20 lbs., the fuel used by Steevens, would be required to get up the steam of the two engines.

Messrs. Garrett worked one of Howard's Four-furrow Ploughs, which will be described further on. The pace was rather slower than with Steevens' implement, the furrow less broken, and the depth more even. The work was fair, though not nearly equal to that made on Plot 1. The labour employed was—

						s.	d.	
Two engineers	..	..	..	..	..	7	0	a day.
One ploughman	..	..	..	..	..	3	0	„
One porter-lad	..	..	..	..	..	2	0	„
Water-cart and boy	..	..	..	..	..	4	0	„
Oil	..	..	..	..	..	1	6	„
Total						17	6	

We noticed an improvement in these engines in the position of the cylinders, which were formerly in the front, and are now brought to about the centre of the engine and placed above and below the boiler. The winding-drums worked smoothly, and the guide-pulleys coiled the ropes with great regularity; the great weight of these engines—nearly twelve tons each when at work—and the fuel consumed for work done, are items which contrast unfavourably with Fowler's double engines working simultaneously.

CLASS I.—TABLE 2. COMPETITION OF STEAM-CULTIVATORS, working nominally at 8 inches deep.

Name.	Number in Cata- logue.	Price.  £. s.	Working Pressure of Steam in lbs.	Nominal Horse-power.	Soil moved per Acre in Tons.	Nature of Work.	Working- time.	Fuel consumed whilst at Work.	Labour and Oil per Day.	Work done.	Number of Acres per Day of 10 Hours.	Cost of Coal per Acre, at 1s. per cwt.	Wear and Tear, and Interest on Capital per Day.	Total Cost per Acre.
1. Fowler	{1540} {1553}	1034 0	70	{2 engines, 7-horse power each.}	{775}	{Cultura- tion.}	H. M. {3 47}	5 1 0	£. d. 18 0	A. R. P. 5 0 22	13.58	1 2	£. d. 18 1.1	£. d. 3 8
2. Garrett	{1593} {1594} {1612}	1028 10	73	{2 engines, 12-horse power each.}	{691}	Ditto	2 49	11 1 14	17 6	5 0 1	17.77	2 3.3	17 11.9	4 3.2
3. Savory	{2284} {2285} {2287}	726 0	100	12	749	Ditto	{Time not taken, owing to accident.}		16 0	4 3 20	..	..	..	..
4. Fowler	{1539} {1544}	875 0	105	14	920	Digging	6 3	9 2 14	16 0	5 0 10	8.37	1 10.7	15 3.6	5 7.5

The remaining trials in Class 1 for Implements competing as *Steam Cultivators* took place on Saturday, July 16th, in a field of thirty-four acres, belonging to Mr. Dod. This was the strongest portion of the land, though still not to be compared with the seven years' fallow field at Worcester. But if the soil was not extraordinarily stiff, it was remarkably dirty, the surface presenting a complete mat of running grass, amongst which the Onion Couch, *Arenatherum arenaceum*, was very conspicuous, and appeared to excite the curiosity of spectators, to most of whom it was a novelty. The field was old stubble; the lots about five acres each, and twenty chains long; the implements working up and down the lands. Four competitors appeared: Messrs. Fowler, with two sets, and Messrs. Garrett and Savory, both using different forms of Howard's Cultivator. Mr. Stevens having no power to draw his implement was unable to compete, which was of the less importance as it came into competition in Class 4.

These trials, being properly regarded as affording the most important test of the value of the different systems, excited much interest; and as the work was prolonged from about 11 A.M. till 7 P.M. the public had an excellent opportunity for careful inspection.

Lots were drawn in the following order.

Mr. Fowler occupied Lot 1, with the double engines working a 4-tined Cultivator. This work was very good, the surface left somewhat rough and open; the ground thoroughly disturbed, the bottom clean and even, and a depth of fully 6 inches moved. The engines were driven at a moderate pace, and consequently good work was possible. Although working deeper than either of the other Cultivators upon a very foul surface, there was no tendency to clog up the form of the frame and breasts allowing the implement to clear itself. The quantity of soil actually moved per acre was 775 tons, exceeding the best work of Howard's Cultivator by 26 tons. We prefer the work by this implement, because, in the event of heavy rain, the vegetable matter would not grow so readily, being more thoroughly shaken and separated from the soil, and in the succeeding operations the implements would more readily break up a rough than a smooth surface.

Lot 2, Garrett's Double Engines (Savory's patent) came next, working one of Howard's large 7-tined Cultivators. The surface was left flatter than Fowler's. The depth did not average more than five inches, the implement overlapped its work, and in places portions were missed. This latter fault was no doubt attributable to the great pace at which the implement was driven (one of the Judges, who was also at Worcester, remarked that these engines could not work slowly). The plot was finished nearly an hour sooner than the others. Notwithstanding the excessive pace, the fuel consumed was enormous, a serious item in most districts. When a request was made that the depth of the work should be increased, the implement immediately clogged up. The soil moved was 691 tons per acre, 84 tons less than on Lot 1.

Lot 3 fell to Savory and Son's Double Windlass Engine, working Howard's small Cultivator with Fowler's Anchor. A series of accidents prevented us from keeping an accurate record of the time. These delays appeared partly due to a want of proper arrangement. Thus the Anchor was placed at too great an angle in reference to the power, and consequently dragged; later on the pumps would not work. The land was well moved, the depth about 5½ inches, the bottom fairly even, and the soil disturbed 749 tons per acre.

Lot 4 was drawn by Fowler, who used his 14-horse engine, clip-drum and windlass, as employed on Lot 1 of the ploughing competition. We believe his original intention was to use the 7-tined balance Cultivator, but finding the soil too firm for this implement, which is intended to cross land already



broken up, he sent for a powerful 3-tined digger, using Cotgreave's forked breasts. This change of plan caused considerable delay, so that noon was past before work commenced. The public were recompensed for the delay, by the sight of some splendid work which we consider fairly deserved to be called digging, as the soil was broken up from 8 to 9 inches deep. This implement appears to us the most perfect that has as yet been used for steam cultivation; it was not the most suitable for the job in hand, as it partly buried the rubbish which should have been on the surface, but as a means of breaking up the soil in rough masses, and leaving the surface exposed to the influence of frost, it is invaluable for autumn work. The soil, 920 tons per acre, was thoroughly moved, an even bottom being left.

We may here remark that having tested the capacity of the various systems for getting up steam, preparing for work, &c., in the previous trial, no further notes were taken on these points. The coal consumed as noted in Table II. is the quantity employed during actual work. In each case the soil was carefully shovelled away, so as to leave a trench right across the work—the character of the bottom was thus ascertained. Our Awards were as follows:—

First Prize, 100*l.*, to John Fowler, for his two 7-horse Engines, &c. (1540).  
 Second Prize, 50*l.*, „ 14-horse Engine, Anchor, &c. (1539).

Highly Commended. R. Garrett and Sons, for Improvements in Double Engines (Savory's patent).

## CLASS II.

The trial of systems for small occupations was conducted on precisely the same plan as those in Class I. On Thursday, July 14, ploughs working 7 inches deep competed. There were three entries: Messrs. Howard, and Messrs. Fowler with two systems. Lots of about 3 acres were measured out side by side. The soil was uniform in character and easily stirred.

Lot 1 was drawn by the Messrs. Howard, who used one of Clayton and Shuttleworth's 10-horse Portable Engines, working their double windlass and four-furrow plough on the well-known round-about system. There is little alteration to notice in their well-made machinery since the Worcester Meeting. The *windlass* has been strengthened by the extension of the supporting brackets. The arrangement for throwing either windlass in or out of gear is ingenious and simple. The shaft works on an eccentric, so that either end can be lowered or raised; as the windlass is lowered its motion is instantly arrested by a wooden break, and when again it is partially raised, and placed in position, a gentle check is maintained which prevents the slack rope from being given off too rapidly; the power that would otherwise be lost, by this operation is partially reclaimed by the action of the double snatch-block, which, since Worcester, has received the addition of a flange on the slack-rope disc.

The plough consists of a strong carriage on four wheels, the moveable frames at either end carrying the working parts, which when out of ground are supported by strong springs fixed on the carriage. The plough is steered by a lever action on the front wheels. The implement has been considerably strengthened, and the vibration noticed in the Worcester Report is not now visible. The Anchor arrangements were unaltered, and there was still the same liability to drag, though no accident of the sort occurred. We particularly call attention to the time occupied in getting up steam and setting down the apparatus as detailed in Table No. III., and to the large horse-strength required to move the apparatus from field to field: to do this at one operation would require about 8 horses—a greater strength than ought to be found on a small occupation using steam power. The cost for labour, &c., would be:—

Engineer

CLASS II.—TABLE 3. COMPETITION OF STEAM-FLAUGHS, WORKING 7 INCHES DEEP.

Name.	Number in Catalogue.	Price.	Working Pressure of Steam in lbs.	Nominal Horse-power.	Time required to get up Steam.	Time required to set down Tackle.	Total Fuel consumed.	Cost of Labour and Oil per Day.	Working time.	Work done.	Number of Acres per Day of 10 Hours.	Cost of Coal per Acre, at 1s. per cwt.	Wear and Tear, and Interest on Capital per Day.	Total Cost per Acre.
		£.			H. M.	M.	cwts. qrs. lbs.	s. d.	H. M.	A. R. P.		s. d.	s. d.	s. d.
1. Howard	{1608} {1609}	630	80	10	1 10	52	7 1 17	20 6	8 32	2 3 28	8·27	2 6·3	11 0·3	6 4
2. Fowler ..	{1541} {1548}	630	100	7	0 52	35	3 2 14	16 0	3 26	2 2 17	7·59	1 4·6	11 0·3	4 4·2
3. Fowler ..	{1543} {1544}	587	80	10	1 10	Not taken	6 0 14	18 6	3 59	2 2 17	6·54	2 4·3	10 3·2	6 9·2

N.B.—The same figures are adopted for wear and tear and interest as in the Worcester Report, viz. 12½ per cent. for wear and tear, and 5 per cent. for interest distributed over 200 days. Oil is charged 1s. a day for single engines, and 1s. 6d. a day for double engines, and is included in the labour column.

						s.	d.
Engineer	..	..	..	..	..	3	6 a day.
Ploughman	..	..	..	..	..	3	0 "
Windlass-man	..	..	..	..	..	2	6 "
2 anchor-men	..	..	..	..	..	4	0 "
2 porter-boys	..	..	..	..	..	2	6 "
Water-cart and boy	..	..	..	..	..	4	0 "
Oil	..	..	..	..	..	1	0 "
Total	..	..	..	..	..	20	6

The work was very good, the furrow laid over evenly, and the depth generally well maintained: nor must it be forgotten that the round-about system is specially adapted for fields of irregular shape, as it can work corners that it would be difficult if not impossible for the direct system to deal with.

Lot 2 was selected by Mr. Fowler for one of his 7-horse Engines and Anchor, working a three-furrow plough, driven at a pressure of 100 lbs. on the square inch; the work done was really extraordinary, much too fast, however, for the furrow to be even; it was more broken and irregular than in Lot 1. The engine moved into the field, drawing the plough behind it, traversing stiff ridge and furrow; three horses brought the remainder of the tackle, which was ready for work in 35 minutes after reaching the field. The consumption of fuel, including getting up steam, was very moderate. The labour the same as that required by the 14-horse Engine as already detailed.

Lot 3 was also occupied by Mr. Fowler, who here showed a modification of his system suitable for an ordinary 10-horse Portable Engine. A self-moving clip-drum on a carriage, firmly attached to the engine, was driven from the fly-wheel by a belt composed of wooden joints faced with iron. This runs very loose, and being of considerable weight bellies down so as to take a good grip of both the driving and driven wheels; the clip-drum carriage draws itself and the engine forward as the work proceeds, by winding up a rope precisely in the same way as the moveable anchor; the windlass-man throwing the drum in and out of gear at the same time that he reverses the motion of the clip-drum. It is a very ingenious arrangement, and may deserve the consideration of those who already possess a portable engine, and have good square fields. Still, at the best, we must regard it as a makeshift, and liable to the same objection as Messrs. Howard's system—viz., the large strength of horses required for removals, and the longer time consumed in preparing for work. These details unfortunately could not be ascertained, in consequence of Mr. Fowler's engine being unprovided with the regulation steam-gauge, so that operations were delayed about two hours whilst one was fitted on. We believe, however, that about the same time would be taken up in this, as in the preceding case. The four-furrow plough was used, and the work done was excellent. As the plots were of unequal length, the Judges counted the number of turns made by each implement, and allowed accordingly. The labour, &c., employed amounted to—

						s.	d.
1 engineer	..	..	..	..	..	3	6 a day.
1 ploughman	..	..	..	..	..	3	0 "
1 windlass-man	..	..	..	..	..	2	6 "
1 anchor-lad	..	..	..	..	..	2	0 "
2 porter-boys	..	..	..	..	..	2	6 "
Water-cart and boy	..	..	..	..	..	4	0 "
Oil	..	..	..	..	..	1	0 "
Total	..	..	..	..	..	18	6

On Friday, July 15th, the trial of *Steam Cultivators* in Class II. took place, in two fields of Mr. Smith's, on the Rising Sun Farm, and we have never seen more excellent trial-grounds. The fields were rectangular, nearly equal in size, 20 and 21 acres respectively, and remarkably even in character. By dividing them in half, plots of about 8 acres were obtained; they were in stubble from last year, and the surface was covered with a goodly assemblage of running weeds, amongst which the onion couch was again conspicuous; we venture to assert that never before has the Society been able to offer such an opportunity for a fair day's work.

Lots were drawn, and the four competitors were thus arranged:—Mr. Fowler occupied the upper half, and Messrs. Coleman and Morton the lower part of the first field, whilst Mr. Fowler and the Messrs. Howard were placed in similar positions in the adjoining field.

Lot 1 was occupied by Mr. Fowler with the portable engine and clip-drum carriage, described above, working a 4-tined digger with Cotgreave's breasts. This implement made good work: it appeared, however, to move much more soil than was actually the case; for though nominally working at 8 inches, it really attained a depth but little over six. The importance of ascertaining the exact weight of soil moved was here evident, and we think it desirable that this test should be extended at future trials. Time only allowed us to weigh 3 yards on each plot; two being taken from the top of the ridge, and the third from the furrow. The mean of the three gives the average weight of a yard of soil moved; greater accuracy would be ensured if the mean of more plots were taken.

On Lot 2 Messrs. Coleman and Morton exhibited their system of cultivation, in which two implements are alternately at work, and always when at work are being drawn towards the engine. There is thus little or no strain upon the anchor, which is much the same as an ordinary snatch-block, whilst the tail-rope is less than half the weight of the draft-rope. The implements meet in the middle of the field; they are constructed on the same principle as the celebrated horse-cultivators of this firm. The engine is a 10-horse double cylinder traction-engine, furnished with two small winding-drums, which are reversed by the engineer. Guide-pulleys, working on a rack, which is moved by the windlass-man, keeps the rope well coiled on the windlasses. The anchor requires moving at every three ends, or after  $1\frac{1}{2}$  bouts. Labour employed consists of—

	s.	d.
Engineer .. .. .	3	6 a day
Windlass-man .. .. .	2	6 "
Two men cultivating .. .. .	6	0 "
Anchor-lad .. .. .	2	0 "
Water-cart and boy .. .. .	4	0 "
Oil .. .. .	1	0 "
Total .. .. .	19	0

The work, which in this case only was in a direction across the furrows, was excellent, a large amount of soil being moved; depth about  $5\frac{1}{2}$  inches; the bottom fairly even, though here and there the narrow tines had grooved out a bed, and left the soil high on either side; the surface was left in a good condition for further operations. Much time was lost from one of the Cultivators breaking from contact with a very large stone; so that when work was stopped at six o'clock, not more than half the plot was completed. We question whether the tines are sufficiently strong for stony land. The soil moved was 641 tons per acre, the most by any of the Cultivators. This was, no doubt, partly due to the implements working across the furrows, and to their capacity for



CLASS II.—TABLE 4. COMPETITION OF STEAM-CULTIVATORS, working nominally at 8 inches.

Name.	Number in Cata- logue.	Price. £.	Working Pressure of Steam in lbs.	Nominal Horse- power.	Soil moved per Acre in Tons.	Nature of Work.	Work- ing time.	Fuel used in actual Work.	Labour and Oil per Day.	Work done.	Number of Acres per Day of 10 Hours.	Cost of Coal per Acre, at 1s. per cwt.	Wear and Tear, and Interest on Capital per Day.	Total Cost per Acre.
							H. M.	cwts. qrs. lbs.	£. d.	A. R. P.	£. d.	£. d.	£. d.	£. d.
1. Fowler ..	{1543} {1544}	587	70	10	680	Digging	6 53	13 2 14	18 6	6 0 14	8 84	2 2 8	10 3 2	5 6 9
2. Coleman	548	700	80	10	641	{Cultiva- ting.	4 24	6 3 11	19 0	3 2 22	8 26	1 10 5	12 3	5 7 8
3. Fowler ..	{1541} {1553}	620	110	7	503	Ditto ..	5 12	6 1 14	16 0	7 3 0	14 9	0 9 8	10 10 2	2 7 4
4. Howard	1608	550	58	10	620	Ditto ..	5 7	13 0 0	20 6 7	2 29	15 01	1 8 3	9 7 5	3 8 3

for going into the low ground. The total cost will appear heavy, probably some extra fuel was consumed in consequence of the delay.

In the adjoining field Messrs. Fowler and Howard ran a neck-and-neck race. Fowler occupied Lot 3, the upper portion, with one of his 7-horse engines, working a 4-tined balance Cultivator. The pressure of steam was seldom less than 105, and ranged between this and 115 lbs. on the square inch. The pace was tremendous; consequently the work was irregular, and in several places portions of ground were missed. The depth varied, but would not average more than five inches; and, as will be seen by reference to the Table, less soil was moved than on any other lot. We strongly deprecate these racing trials, which really afford no criterion of what can be done in an ordinary day's work on a farm. Here was a rare opportunity for showing really good work in a practical form; and instead of this we saw the power of a nominal 7-horse engine to do the work of a 12 or 14-horse engine, and some very indifferent cultivation. We trust the public will not suppose that good cultivation can be effected for a total cost of 2s. 7<sup>4</sup>/<sub>d</sub>. per acre. If they double this sum they will probably be still under the mark. Except on quite light soils, a 7-horse engine is not sufficiently powerful; and we are convinced that Mr. Fowler would not recommend his customers, except under peculiar circumstances, to invest in a *single* engine of this class. It is always good economy to have so much power that the engine may be master of its work. What would be the condition of an engine after a year's work similar to this trial? Would it not be worn out, or at any rate greatly injured? Our calculations for wear and tear are, consequently, altogether insufficient for such work as this.\* Then, again, let it be borne in mind that good work on a hard unbroken surface is impossible when the implement is driven fast. Three miles an hour is the outside pace for work such as this, and whenever this is exceeded something must suffer. There is another consideration that may well induce the Society to check such exhibitions, viz., the public safety. It was a most fortunate circumstance that this engine was working from the near side: had it been otherwise, the fly-wheel, which from some imperfection in the key (which either fell out or broke) fled off the shaft, instead of alighting against the hedge, must have dashed into the group of spectators, causing a frightful loss of life. It may be said that this was quite an exceptional accident, but was it not in consequence of the excessive speed causing intense vibration, that the key gave way?

Messrs. Howard, in Lot 4, made better work than Fowler, though here the pace was much faster than would be desirable for every-day work. The smoke-box and lower part of the funnel were nearly red hot, and would very soon have been burnt through, and the wear and tear must have been great. The implement travelled at a great pace, and coming in contact with a large stone, the shock was sufficient to throw the driver with violence to the ground, where he lay for some minutes stunned and sick. The land was decidedly better moved than Lot 3, though here and there we found missed spots, and we should have preferred a somewhat rougher surface. 620 tons were moved per acre, the average depth being about 5<sup>1</sup>/<sub>2</sub> inches. It will be seen that the time occupied in actual work was nearly identical: had the time of getting up steam, setting down tackle, &c., been noted, Fowler would have gained somewhat. Here, again, as in all the other trials, Fowler's engines prove themselves the best constructed to economise fuel; this is probably due to the greater extent of heating-surface in the boiler in proportion to the horse-power. We have

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\* In reference to this question, we may remark that the actual wear and tear on the boiler and furnace of an engine bears a close proportion to the amount of fuel consumed; thus the greater the latter, the greater will be the wear and tear.

Clayton and Shuttleworth's engines consuming more than double the coal used by Fowler's 7-horse engine.

We award as follows :—

First Prize, 50*l.*, to John Fowler, for 7-horse Engine, Anchor, &c. (1541).

Second Prize, 25*l.*, to J. and F. Howard, for Apparatus (1608).

In concluding this portion of our Report we would remark that, whilst the result of these trials proves incontestably that steam power can economically compete with horse labour, it is not so much in the mere saving of cost as in the superior quality of the work, and consequent influence on produce, that steam asserts its superiority over animal power for strong soils.

### CLASS III.

#### *Ploughs for Steam Power.*

Messrs. Fowler, Howard, and Stevens entered in this class. The trials took place on Friday, July 15th, in a portion of Mr. Jamieson's stubble field. Messrs. Savory's Double Windlass was used, and one of Messrs. Howard's Anchors. The draft was tested by a new and very beautiful Dynamometer, designed by Messrs. Easton and Amos specially for the Newcastle Show. Mr. Amos has kindly forwarded us the following description of this ingenious piece of machinery: "In testing the traction force required to move cultivating implements drawn by steam power, the ordinary dynamometer, which travels over the land, is incapable of registering results correctly, owing to the ever varying resistance caused by irregularities of the surface. It therefore appeared desirable that a fixed dynamometer should be constructed, capable of correctly registering the tractive force or strain caused by the resistance of the cultivating implement on the wire rope, and giving the total amount of power used in an experiment to overcome resistance, however variable that resistance might be, as regards time or intensity. These ideas were matured, and the result was the Newcastle Dynamometer. The train of reasoning used in the invention of the instrument was in conformity with the law of statics; thus, if a rope be passed over two pulleys placed some distance apart, and weights of unknown amount be fastened to each end of the rope, it is no difficult task to ascertain the amount of the weights so placed. For if upon the rope, midway between the two pulleys, we hang a known weight of any amount, it will cause the rope to be deflected from a straight line; then all that is required is to multiply the central weight in lbs. by the distance from the central weight to one of the pulleys, upon which the rope rests, in inches; divide the product by twice the deflexion of the rope, the quotient is the weight in lbs. of either of the weights which tend to tighten the rope over the pulleys, or in other words, is the measure of the strain on the rope. The instrument consists of a strong wooden frame, mounted upon carriage-wheels, having on its centre a strong cast-iron vertical socket. A cast-iron screw column, fitted with a fly nut, drops into this socket and moves freely in it, and the column can be raised or lowered by the fly nut. To the top of the column is fitted a long arm of wood by a joint at the centre, so that either end can be raised or depressed. The arm thus possesses a movement both horizontal and vertical, like that of a transit instrument. At each extremity of the arm a pulley is placed, which turns freely on vertical pins, the centres of these pulleys being 18 feet apart. At the centre of the arm is a central pulley with vertical spindle, carried by two strong springs. These springs are so placed that they deflect the central pulley twelve inches out of a straight line between the other two. The rope passes over the end pulleys and under the central one, so that the deflexion of the unloaded rope is twelve inches. The instrument being fixed in a position between the engine and the Cultivator, the tractive force on the rope is shown

by the deflexion of the middle pulley becoming less. The greater the tractive force, the less the deflection of the rope. The results are accurately registered, however variable they may be both as to time and intensity." Without carefully prepared diagrams, which Mr. Amos has not had time to complete, it would be impossible to explain the arrangements by which the indicator works.\*

As the Dynamometer was constructed to register only in one direction, the implement and rope was in each case drawn back with horses. The land was very rough, consisting of narrow high lands, across which the ploughs were drawn. This was a trial which severely proved the capacity of the implements for sticking to their work, and the way in which the soil was moved through the furrows was particularly noticed. Steevens' Plough did not maintain its depth, turned over a rather broken furrow, and often almost missed the low ground. We are more and more satisfied that this implement, highly ingenious though it be, is not yet strong enough for heavy land; it does not stick to its work either as a plough or cultivator should do. Messrs. Howard and Fowler both made much better work. The principle on which the Balance Plough is made, seems the best yet invented for general purposes. In this class Messrs. Howard exhibited a Two-furrow Plough, similar in construction to the ordinary plough, but intended to work at an extra depth. We have no doubt that in deep fen-land, or where, as in the South of France, very deep ploughing is desirable, this implement would prove very efficient. The subjoined Table will explain the actual results in each case.

Name.	Number in Catalogue.	Price.	Distance run in Yards.	Time occupied.	Draft of Plough in lbs.	Horse-power employed.
		£.		min. sec.		
Steevens .. ..	1310	65	{ 98	1 10	1654·9	12·64
			{ 84	1 20	1495·6	8·56
Fowler .. ..	1544	97	{ 107	1 28	1307·	8·73
			{ 103	1 20	1357·9	9·6
J. and F. Howard	1609	80	{ 96	1 25	1507·9	7·17
			{ 95	1 15	1614·	9·84

The last column shows the average horse-power required to work each implement; one horse-power is by definition a force which will lift 33,000 lbs. one foot high in one minute.

Award :—

First Prize, 20*l.*, to John Fowler.

Second Prize, 10*l.*, to J. and F. Howard.

Silver Medal to W. Steevens, for Improvements in Steam Plough.

We Highly Commend J. and F. Howard for Two-furrow Plough (1611).

#### CLASS IV.

##### *Cultivators for Steam Power.*

This was one of the most interesting features of the trials, especially when we consider the importance of the Cultivator in relation to steam power. Five implements were entered for competition. Messrs. Howard's Engine, Windlass, &c. were employed, and one land of clover stubble given for each trial; the revo-

\* Diagrams and a full description of the Newcastle Dynamometer will appear in the next number of the Journal.



lutions of the engine being carefully noted in each case. The Dynamometer described above was fixed a little distance from the engine, in such a position that the draft on the rope could be registered as the implements travelled up the land; each implement was allowed to proceed up and down in order to arrange the depth, the test was then applied, generally twice, the time accurately noted, and the distance measured through which the implement travelled. In each case a portion of soil was weighed, the width of work ascertained, and thus the actual draft for a given weight of soil moved was found. The work was laid bare right across each lot, so that the character of the bottom and the depth attained were apparent. In connection with this object we measured a square yard on the unbroken surface, and weighed the soil to a depth of six inches; the result was 3 cwt. 2 qrs. 15 lbs.; this will be some guide as to the depth disturbed by each implement.

Name.	Number in Catalogue.	Width taken by Implement.	Yards run.	Time occupied.	Draft in lbs.	Weight of a Yard Square.	Actual Horse-power employed.	Total Units of Power expended.	Earth moved, in Tons.	Units of Power required to move 1 Ton.
		ft. in.		M. S.		cwt. qrs. lbs.				
1. Howard A. } Ditto B. }	1607	3 5½	{ 130·6 158·8	1 15 1 48	3950 3982	3 2 5 4 0 7	37·52 31·43	1547700 1866942	26·68 37·18	58009 50208
2. Fowler . .	1553	3 10	{ 81·62 83·39	1 0 0 57	3176 2892	3 1 24 3 1 24	23·55 23·9	777150 749265	18·06 18·45	43024 40599
3. Steevens . .	1310	2 10	{ 85·14 86·24	1 0 1 0	2660 2431	2 2 23 2 2 23	20·57 19·05	678810 628650	10·87 11·02	62419 57150
4. Coleman . .	549	3 10	{ 91·0 82·7	1 0 1 0	4194 4699	3 1 17 3 1 17	34·7 34·57	1145100 1140810	19·67 17·97	58209 63484
5. J. A. Williams	2037	3 0	79·4	1 0	3767	3 0 17	27·27	899910	12·51	71936

N.B. The unit of power is the force generated by 1 lb. falling through the space of 1 foot; 1 horse-power is by definition a force which will lift 33,000 lbs. 1 foot high per 1 minute.

Lot 1.—Messrs. Howard worked their 3-tined Cultivator, first with narrow shares, and afterwards with broad shares. The results are lettered A and B in the preceding Table. The Cultivator consists of a ribbed wrought-iron frame, very strong, and is so arranged that the tines furnished with double points rock on the frame, so that as the points in work are depressed the hinder ones are slightly raised. The arrangements for altering the shares are not so simple as they might be, and caused a considerable delay. The narrow tines left a very uneven and ridgy bottom. The implement worked full 6 inches in the deepest parts, and the soil was moved at the rate of 857 tons per acre. The broad shares which cover all the ground left a more even bottom; and though they worked at the same depth, a greater weight of soil was moved, equal to 983 tons per acre. The width disturbed was in both cases 3 feet 5½ inches.

Lot 2.—Fowler, working the 4-tined balance Cultivator, made some excellent work. This implement was submitted to a second trial, as an objection was raised to the first experiment. The bottom was decidedly the most even of all the trials; the depth somewhat less than in Lot 1; 847 tons per acre were moved. The width stirred was 3 feet 10 inches. The lighter draft of the balance Cultivator is partly accounted for by the fact that this implement clears its way by getting rid of the soil, throwing it on one side, whilst other Cultivators cut their way through a dead mass of earth, which, as soon as disturbed, falls back, and checks the onward course of the implement. The surface was left in a good condition for after work.

Lot 3.—Mr. Steevens' combined implement, described before, worked with narrow tines, and left a most uneven bottom. It was explained to us that better work would have been made had broader shares been substituted. We have no doubt this would have been so; but why, then, was it not so exhibited? The Judges are called upon to decide on the merits of implements as they come before them. As it was, the work was decidedly bad. And in this rather hard soil we again had evidence that Mr. Steevens' implement is liable to shirk its work; probably the weight of the frame which carries the tines is insufficient to keep it quite steady. The soil moved was at the rate of 654 tons per acre, the width of the implement 2 feet 10 inches.

Lot 4.—Coleman and Morton's Cultivator made fair work; the bottom was, however, somewhat uneven, the tines being too narrow for this hard soil. In this case the draft of the empty implement was added, since the system requires two Cultivators—one in, and one out of work. Soil moved, at the rate of 823 tons per acre; width disturbed, 3 feet 10 inches. We were pleased with the work of this Cultivator on both occasions that it came before us, though we do not approve of a system that requires two implements to do only the work of one.

Lot 5 was occupied by Mr. J. A. Williams with his Leviathan Cultivator, an enormous implement, which covers 6 feet 2 inches between the wheels and disturbs 6 feet of ground. It consists of a strong rectangular frame on three wheels; two support the body, and one in front is used for steering. The frame carries a series of head-blocks, set perpendicularly by screws which regulate the depth of the forepart of the cultivating-shares. Three cultivating-frames are attached, each carrying three cast-iron coulter. The coulters are  $3\frac{1}{2}$  inches wide, by  $1\frac{1}{2}$  inch thick, bevelled fore and aft. Three descriptions of shares are provided—narrow chisels, broad chisels, and steel broad-shares, which cover all the ground. The cultivating-frames are independent of the carriage-frame, being raised out of the ground and kept to a given depth, or rather prevented from entering the ground too deeply by a lever-press; in other words, we have much the same arrangement as in the coulter of a drill, only the press is there employed to keep the coulters in the ground, and here to prevent their drawing in too deeply. The man steers from a seat on the carriage-frame; the implement turns at the land's end; it weighs about 1 ton. Mr. Williams' plan of cultivation consists in going twice over the same ground; the depth cultivated was very irregular. The frames, each acting as independent levers, jumped about a good deal, and kept rising and sinking as far as the press allowed, according to the obstructions in the soil. The soil moved was at the rate of 762 tons per acre. Width twice moved, 3 feet.

The Award was as follows:—

	£	s.	d.
First Prize to John Fowler .. ..	17	10	0
Second Prize to J. and F. Howard .. ..	12	10	0
Silver Medal to Coleman and Morton.			

#### CLASS V.

##### *Trial of Steam Harrows.*

These trials took place on Saturday, July 16th, the ground selected being the three lots ploughed by the competitors in Class II. The whole area, about 8 acres, was divided into five equal strips; lots were drawn, and each implement worked across the three ploughings. Messrs. Howard kindly lent their power, which proved very suitable for the work; after each implement had traversed a *bout*, the large horse-plough Dynamometer was attached, and

an observation taken in both directions. It will be seen that the draft was in each case greater when the implement was travelling from the engine.

Name.	Number in Catalogue.	Cost.	Description.	Distance run in Yards.	Time occupied.	Width of Land harrowed.	Draft in lbs.	Draft in lbs. per Foot in Width of Land harrowed.	Horse-power employed.
1. Kelsey . . .	2440	£. s. 12 12	American triangular Harrow	Trial discontinued, owing to excessive draft caused by imperfect traction adjustments.					
2. J. and F. Howard	1614	30 0	Norwegian Harrow	170	M. s. 2 20	ft. in. 6 10	1799	263.3	11.9
Ditto.	..	..	..	158	2 20		1744	255.2	10.7
3. J. and F. Howard	1613	22 0	Drag Harrow	165	1 53	10 0	1598	158.8	12.4
Ditto.	..	..	..	154	2 10		1521	152.1	9.8
4. Fowler . . .	1554	50 0	Ditto	157½	2 5	11 7	1967	169.8	13.5
Ditto . . . .	..	..	..	162½	2 5		1947	168.0	13.8
5. Ashby . . . .	2033	20 0	Double Circular Harrow	Trial discontinued, owing to breakage from imperfect traction adjustment.					

N.B. The last column shows the average horse-power required to work each implement.

No. 1.—Kelsey's Harrows are an American invention, of some merit, though not seen to advantage on this occasion, because the imperfect adjustment of the draft caused the implement to bury itself in the soil, and act as a Cultivator rather than a harrow. We consider the arrangement of the tines simple and good. The implement consists of a strong wooden frame, forming 2 equilateral triangles, one placed within the other. The teeth are so arranged as to cut the ground alternately in either frame, at equal distances apart; and it is evident that if it be properly balanced, nothing can escape the action of the teeth. It has never been tried before with steam-power. The inventor proposes to draw it backwards and forwards without turning: experience can alone decide whether this is practicable; we think in foul land the implement would clog up when the broad end of the triangle meets the soil. Should this be the case, an arrangement for turning might readily be introduced.

No. 2.—Messrs. Howard worked their Norwegian Harrow, consisting of three rows of star-shaped discs, working between each other, and thus completely comminuting the surface. This implement acts as a combined harrow and presser, pulverizing the surface, and at the same time consolidating the under soil. Crossing the rather open furrows of a clover ley, this implement was in its right place. It requires, however, a dry surface, and land free from stones, and its value is rather exceptional than general. The trial was very successful.

No. 3.—Messrs. Howard's Steam Harrows, made on the zigzag principle, and provided with a simple steerage and seat for the workman, are excellent implements for crossing fallows in the spring. The length of tines and weight of frame cause all these implements to work rather as Cultivators, cutting through the furrow, than as harrows proper. The width taken is so great that, in order to break fresh ground at each turn, the harrow has to start forward a short distance, then retrace its steps, and thus get into its proper track; practically we should double our work, and thus do away with this dodging backwards and forwards, and loss of time. Looking at the



moderate cost of these drag-harrows, the quantity of work they could accomplish, the quality of the operation, and their adaptation for any kind of steam power, we think Messrs. Howard have produced a very valuable implement.

No. 4.—John Fowler's Steam Harrows are provided with slack-gear; they are attached to and work between the fore and hind wheels of a carriage which carries the slack-rope drums. The weight of this carriage is considerable, and the pressure of the hind wheels upon the work a disadvantage. The cost of the implement is also an objection; 50*l.* is too much to pay for such a tool. The work was very good, the surface more broken than No. 3, due to the fact that the teeth, whilst somewhat shorter, are nearer together.

No. 5.—Mr. Ashby tried an enormous pair of rotating harrows, of great weight, furnished with strong round tines; the diameter of the two harrows, and consequently the width of soil they would disturb, was 13 feet 8 inches. So great was the power required to move these harrows in the form they assumed at the trial, that the iron bar to which the rope was fastened was bent double without the implement being moved. Mr. Ashby informed us that it was intended to attach them to Fowler's slack-gear carriage, and thus the depth and draft could have been properly regulated. Unfortunately, time did not allow of a second trial. In reference to the very interesting figures resulting from the Dynamometer tests, the two last columns are the most important, showing the actual draft for every foot in width harrowed, and the average horse-power required to work each implement. We think it is clear that whilst dragging may be in some instances economically substituted for cultivating, horse-power will have the advantage for harrowing operations.

We award the Prize of 20*l.* to J. and F. Howard.

#### CLASS VI.

##### *Windlasses and Application of Power thereto.*

The object of the Society in offering this prize was to ascertain by which system of *haulage* a given amount of work was performed with the least expenditure of power. We understand that our decisions have been objected to in some quarters, under the idea that a windlass can only refer to machinery on which a rope is wound, and therefore that a clip-drum cannot be a windlass. Those, however, who arranged the wording of this prize, and who are eminently qualified to decide this point, considered that any machinery by which the rope is hauled and enabled to draw an implement through the soil is to all intents and purposes a windlass, and eligible to compete in this class. These trials, as well as those for Cultivators, were unavoidably delayed until Monday, July 18. This was in one respect an advantage, as the superior attractions of the Show Yard secured us a clear field, which was of the utmost importance, and the progress of the work, after the preliminaries had been arranged, was most satisfactory, affording a striking contrast to our experience in Class III., when the trials were frequently impeded, and at last put a stop to, by the crowding of spectators. Once again we venture to make a suggestion. It is that Dynamometer trials should take place before the public trials are announced. There were several very interesting points that we would gladly have investigated, but time did not permit. Mr. Amos arranged these trials in the following manner. Mr. Fowler's 14-horse Engine drove each of the windlasses in succession through the large 50-horse power Dynamometer. The windlasses were detached from the working parts (piston and slides, &c.) of each engine, so that the draft registered indicated the actual power required by each system of *haulage* to perform a given quantity of work. Fowler's Three-furrow Plough was used, working at a fixed depth 7 inches, and taking a regular furrow 10 inches in width. It is therefore



evident that so long as the speed was equal, and the same amount of soil moved in each case, the result must present a true verdict. There were four competitors, Messrs. Coleman and Morton, W. Savory and Son, with the double Windlass Engine, John Fowler, and J. and F. Howard. The draft was taken in both directions, except in the last turn with Messrs Howard's Windlass, when one of the plough-shares came in contact with a fast stone, the body or skife broke; and the lateness of the hour, 8.30, prevented any further trial.

Having ascertained the upward draft, we could easily make deductions for the lighter draft when coming down hill, similar to those which the other trials warranted.

Name.	Number in Catalogue.	Distance run in Yards.	Time occupied.	Actual Horse-power employed.	Cubic Feet of Earth moved.	Total Units of Power expended.	Units of Power Expended in moving 1 Cubic Foot of Earth.	Direction run.
Coleman and Morton .	548	128	M. S. 2 0	11.86	560	782760	1397.7	Uphill.
Ditto. .	..	138.8	2 10	11.36	607.25	809740	1333.4	Down.
Savory and Sons . . .	708	140.5	1 30	21.04	614.6	1,041480	1694.5	Uphill.
Ditto. . . .	..	145.4	1 25	20.00	636.1	934560	1469.2	Down.
Fowler . . . . .	1541	141.9	1 55	14.6	620.8	923128	1486.9	Uphill.
Ditto . . . . .	..	151.8	1 55	13.1	664.1	859900	1294.8	Down.
Howard . . . . .	1608	131.3	1 55	14.6	574.4	923128	1607.1 1398.6 (as estimated).	Uphill. Down.

The reader's attention is requested to the actual horse-power employed, and the units of power required to move 1 cubic foot of earth. It may be well to notice that in Fowler's case the winding apparatus of a 7-horse engine was employed, and yet the power required to work a 3-furrow plough was equal to 14 horses. Howard's windlass, to be driven by a nominal 10-horse engine, takes also 14-horse power. So much for nominal horse-power! We gather from these experiments the importance of having plenty of power. This horse-power, however, must not be taken as representing the exact power that would be consumed, because the question is affected by the speed arrangements of the different systems.

We made the following awards:—

First Prize to John Fowler	..	..	..	..	£15
Second „ J. and F. Howard	..	..	..	..	10
Third „ W. Savory and Sons	..	..	..	..	5

## CLASS VII.

### Steam Anchors.

There was very little competition in this class. The only novelty that was exhibited being Collinson Hall's Anchor, already described; and as he withdrew his apparatus from competition, we had no opportunity of testing its merits. The Anchor arrangements of Messrs. Fowler, Howard, and Coleman, were brought thoroughly under our notice in the various trials, and we had no difficulty in deciding that a Self-moving Anchor was in principle superior to any other, and therefore awarded the—

Prize of 20*l.* to John Fowler.

## CLASS VIII.

*Rope-porters.*

Messrs. Aveling and Porter's Travelling-carriages, and some improvements in the ordinary Porters by Messrs. Coleman and Morton, were the only novelties in this class.

The Travelling-porters are intended to carry the *implement* rope, the *outer* rope being best carried by the ordinary three-wheel porters. The object is to save friction of the rope and labour to the boys, who are placed at either end of the work, and have to unhitch or hitch on the porters as the case may be.

Mr. Aveling worked them on Saturday with Messrs. Garrett's Double Engines, the single rope of this system showing them off to advantage. On level land they answer admirably, saving the rope considerably—strong lads are required to manage them. The carriages consist of two light travelling-wheels supporting a hollow iron rod (one-inch gas-pipe), with a V clip at either end. One end terminates in a handle, and the other in a coil, which passes round the rope, and allows of the rope being picked up, so to speak, whilst in motion, and it is held tight by the V clips, which are worked by a trigger-piece. The arrangements are so good in this respect that the porter and rope appear as one, and away it runs over rough ground or smooth, jumping about, it may be, but never becoming detached. In working very hilly land this system would not answer so well, as in such cases we often require a fixed porter at a certain point, to prevent the rope grubbing on the ground. These carriages cost 3*l.* a-piece, and as 6 to 8 would be required in a length of 350 yards, besides as many large porters for the outer rope, the expense is therefore considerable. If, however, a real saving in the rope is effected, which experience can alone decide, this is not a material point, and we consider the Travelling-porters an ingenious and promising invention.

Messrs. Coleman and Morton exhibit improvements in both small and large porters, which are deserving of notice. The friction-wheel on the large porter is hung upon an upright, that has sufficient play to allow of the wheel inclining to any moderate angle according to the stress of the rope. If, as is not unfrequently the case, the porter is set down badly or pushed out of its course, the pulley-wheel adapts itself to the direction of the rope and undue friction is avoided.

In the small porter, the pulley-wheel works loose on the axle, which is of some length. When at work the inclination of the axle causes the pulley to remain close to one side; when, however, the rope is to be caught, the pulley slides to the opposite end of the axle, where a guide iron is fixed, which directs the rope on to the wheel. This ingenious arrangement appeared to work satisfactorily.

Our Award was as follows :—

10*l.* to Messrs. Aveling and Porter, for Travelling-porters.

5*l.* to Messrs. Coleman and Morton for Improvements in ordinary Porters.

Highly Commended. John Fowler.

Commended. J. and F. Howard.

In conclusion, we may state that the great feature of the Newcastle Steam Trials, as indicating progress since the Worcester Meeting, consists in the use of two engines working simultaneously. The Double Engine system appears now to be fairly started, and likely for many purposes to supersede the Anchor arrangements. Nor must we forget that the clip-drum is the parent of this system, for with no other windlass used for steam cultivation could it have been possible. We may notice the high finish of Messrs. Fowler's and Howard's machinery, and the increased strength of the various parts to bear

the strain, as proved by the fact that throughout these extended trials no serious accident occurred to either of these makers. Messrs. Garrett's Engines (on Savory's patent) are improved since last year. Their great weight, costliness, and heavy consumption of fuel, incline us to believe that they are capable of still greater improvement.

We cannot conclude this Report without tendering our sincere thanks to the Stewards of our Department for their kindness and courtesy, and for the untiring energy they displayed in bringing these Trials to a successful conclusion; nor must we omit to offer our public thanks to Mr. Amos and his son, for the excellence of their arrangements, and for the courtesy and attention with which our suggestions were received and acted upon: the more interesting features of this Report, viz., the tabulated results of delicate dynamometric tests, are entirely the result of their exertions.

D. K. CLARK, C.E.

H. B. CALDWELL.

CLARE SEWELL READ.

FRANCIS SHERBORN, Jun.

JOHN COLEMAN.

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*Report of the Judges on Horse Ploughs, &c., at Newcastle.*

The prizes offered by the Royal Agricultural Society in this department were as follows:—

	£
For the Class of Wheel Ploughs .. ..	30
"    "    Swing Ploughs .. ..	30
"    "    Subsoil Ploughs .. ..	10
"    "    Paring Ploughs .. ..	10

Considering it desirable that the competition of Ploughs should be arranged in three divisions, viz., Light Land Ploughs, General Purpose Ploughs, and Ploughs for heavy land, we visited the stands of the various makers, and selected such implements as appeared most suitable for competition; these came from all parts of the kingdom, from Huntley in the north, to Essex in the south, and included

10 Wheel and	5 Swing Ploughs for light land
10       "    10       "    "	general purposes
10       "    2       "    "	heavy land
6 Subsoil, and 4 Paring Ploughs.	

Besides the above, we tested six Digging Ploughs and a Ridge Plough, and we also inspected the work of a combined Plough Drill and Harrow.

The field selected for the trials was a clover stubble at Long Benton, presenting an even surface; the soil, a strong clay loam, with stones intermixed, was uniform in character, and rested on a stiff clay subsoil. The hard, dry condition of the soil caused the trials to be very severe, and well calculated to show the capabilities of the different implements under difficulties.

## CLASS I.—LIGHT LAND PLOUGHS.

*Wheel Ploughs.*—In this division, as before stated, ten ploughs were selected for trial. After seeing these at work for some time, and carefully examining both the implements and their work, while in progress and at its completion, we selected four to be further tested by the Dynamometer.

In carrying out these interesting experiments we had the assistance of one of Mr. Anson's aide-de-camps, Mr. Geoghegan, to whom our thanks are due for the care and patience he displayed in overcoming difficulties caused partly by the hard state of the ground, and partly by the crushing and crowding of spectators. The following table gives these results:—

Name.	Number in Catalogue.	Price.	Distance in Yards run.	Dimensions of Furrow.	Cubic Feet of Earth removed.	Time occupied in Experiments.	Draught of Plough in lbs.	Actual Horse-power employed.	Total Units of Power expended during Experiments.	Units of Power to remove 1 Cubic Foot.
J. and F. Howard	1615	£ s. d. 5 5 0	70}	" "	123·9	min. sec. 1 20	335·3	1·68	140828	1136·6
Ditto.	"	"	70}	8·5×5	123·9	1 12				
Ransome and Sims	1758	4 15 0	70}	8·5×5	123·9	1 8	258·2	1·49	108444	875·25
Ditto.	"	"	70}			1 4				
W. Ball and Son	2382	4 14 6	72}	8·5×5	127·5	1 7	315·9	1·83	136468	1070·5
Ditto.	"	"	72}			1 9				
Hunt and Pickering	1662	4 12 0	65}	8·5×5	120·4	1 4	264·4	1·48	107875	895·9
Ditto.	"	"	71}			1 8				

*Note.*—The unit of power is the force required to lift 1 lb. 1 foot high.

*Swing Ploughs.*—Of the five ploughs selected, only four started. Of these, that of Messrs. Ransome and Sims, marked 1779 in the catalogue, and costing 3*l.* 17*s.* 6*d.*, made such decidedly superior work that we considered any further test unnecessary.

We award as follows:—

To Messrs. Ransome and Sims for Wheel Plough (1758)	£ s. d. .. 7 10 0
" " " Swing Plough (1779)	.. 7 10 0

We highly commend Messrs. Howard's Wheel Plough (1615).

" commend W. Ball and Son's Wheel Plough (2382).

" " Messrs. Hunt and Pickering's Wheel Plough (1662).

## CLASS II.—GENERAL PURPOSE PLOUGHS.

*Wheel Ploughs.*—We tried ten ploughs in each division of this class, which, as might be anticipated, was most attractive to the numerous spectators. It is manifest that an implement capable of economical work in soils, light and heavy, and equally available for shallow or deep work, will be more sought for than such as are suitable to particular cases only. We tried these ploughs at two depths, first at 5 inches, and afterwards at 7 inches, and such was the condition of the soil, that it was quite sufficient work for two powerful horses to draw the implements at the latter depth. We selected six ploughs for further testing; the result is contained in the following table:—



Name.	Number in Catalogue.	Price.	Distance run in Yards.	Dimensions of Furrow.	Cubic Feet of Earth removed.	Time occupied in Experiments.	Draught of Plough in lbs.	Actual Horse-power employed.	Total Units of Power during Experiments.	Units of Power expended to remove 1 Cubic foot of Earth.
Ransome and Sims Ditto.	1761 "	£ s. d. 5 0 0 "	70·5 71 }	" " 9·5×6·5	182·03	min. sec. { 1 22 1 26 }	487·19	2·23	206,812	1136·1
J. and F. Howard Ditto.	1617 "	5 10 0 "	71·5 71 }	9·5×6·5	183·02	{ 1 19 1 16 }	462·15	2·32	197,569	1077·7
W. Busby . . . Ditto. . .	399 "	4 10 0 "	71 74 }	9·5×6·5	186·5	{ 1 15 1 19 }	523·4	2·72	229,854	1232·4
Seaman and Co. . Ditto. .	572 "	5 7 6 "	59·5 71 }	9·5×6·5	167·8	{ 1 22 1 28 }	549·4	2·30	215,090	1291·8
Hunt and Pickering Ditto.	1663 "	5 2 6 "	71 70·5 }	9·5×6·5	182·03	{ 1 15 1 22 }	483·5	2·37	205,245	1127·5
W. Ball and Son . Ditto. .	2380 "	4 14 0 "	71 70·5 }	9·5×6·5	182·03	{ 1 20 1 21 }	458·8	2·21	194,760	1069·9

These tables, which have been carefully prepared for us by Mr. Amos, contain many interesting points. The small amount of variation in the draught of the several ploughs shows how nearly perfection has been attained in their construction. The last column, which may be said to sum up all the rest, deserves special attention, as enabling us to make the most complete and exact comparison of the actual draught of the different implements when removing a given quantity of earth. The unit of power spoken of is the power required to lift 1 lb. one foot high.

*Swing Ploughs.*—In this division we proceeded in a precisely similar manner, working the implements at two depths, and carefully examining every point. We selected three for the Dynamometer test, the result was as follows :—

Name.	Number in Catalogue.	Price.	Distance run in Yards.	Dimensions of Furrow.	Cubic Feet of Earth.	Time occupied in Experiments.	Draught of Plough in lbs.	Actual Horse-power employed.	Total Units of Power expended during Experiments.	Units of Power expended to remove 1 Cubic foot of Earth.
Ransome and Sims	1781	£ s. d. 4 2 6	73·5	" " 9·5×6·5	94·5	min. sec. 1 22	556·1	2·72	122,620	1297·5
J. and F. Howard Ditto.	1620 "	5 2 6 "	73 72	9·5×6·5 "	186·4	1 37 1 25 }	608·5	2·64	264,697	1419·2
McGregor and Co. Ditto.	2935 "	4 10 0 "	72 65·5	9·5×6·5 "	176·8	1 26 1 12 }	546·4	2·82	225,390	1274·8

*Note.*—Ransome and Sims's first run was lost by the plough being stopped by a large stone.

We would here remark that too much stress must not be laid upon the Dynamometer tests of the swing ploughs, as owing to the hardness of the ground, and the absence of wheels to steady the implements, the draught was very unequal, and even with wheels great difficulty was experienced in obtaining an equal draught throughout. Indeed, we very much doubt whether it is possible, with horse-power, to obtain in hard or stony land an absolutely correct result from the Dynamometer. A little difference in the holding of the plough, or the height of the horses acting on the hold the driving-wheel of the

Dynamometer takes of the ground, may make a considerable difference in the result. To make these tests thoroughly reliable, we would suggest that the ploughs, when being tested, should be drawn by steam-power, so that not only might furrows of uniform depth and width be turned, but turned in exactly the same time, and with the same pressure on the wheel of the Dynamometer.

We award as follows:—

To Messrs. J. and F. Howard, for Wheel Plough (1617)	.. ..	£ 15 0
„ Ransome and Sims, for Swing „ (1781)	.. ..	15 0
We highly commend Ransome and Sims for Wheel Plough (1761).		
„ „ W. Busby and Co. „ „		(399).
„ „ Seaman and Co. „ „		(572).
„ „ J. and F. Howard, for Swing „		(1620).
We commend M <sup>c</sup> Gregor and Co. „ „ (2935).		
„ „ William Ball and Son for Wheel „		(2380).

### CLASS III.—HEAVY LAND PLOUGHS.

*Wheel Ploughs.*—Of the ten implements selected in this division of Class III. only eight started, two exhibitors declining to compete when they understood the nature of the work they were expected to perform, viz., to turn a furrow from 9 to 10 inches deep, and thus move, in most cases, a couple of inches of the hitherto undisturbed subsoil. The work generally was good, but we must specially notice that performed by Messrs. Ransome's Implement (1764), price 6*l.* 10*s.*, which was most excellent. Messrs. Howard's (1619), price 7*l.*, and Messrs. Ball's (2384), price 5*l.* 12*s.*, also did very good work, whilst Messrs. M<sup>c</sup>Gregor and Co., exhibited a strong useful plough (2933), price 7*l.* 2*s.* 6*d.*

At the request of the Messrs. Howard we tested theirs and Messrs. Ransome's ploughs, with the following result:—

Name.	Num- ber in Cata- logue.	Price.	Dis- tance in Yards run.	Dimen- sions of Furrow.	Cubic Feet of Earth removed.	Time occupied in Experi- ments.	Draught of Plough in lbs.	Actual Horse- power em- ployed.	Total Units of Power expended during Experi- ments.	Units of Power expended to remove 1 Cubic foot of Earth.
J. and F. Howard	1619	£ 7 0	73	15×10 {	468.75	min. sec. { 1 6 }	1361.5	8.19	612,675	1307.0
Ditto.	„	„	77	15×10 {		{ 1 10 }				
Ransome and Sims	1764	6 10	73	{ 15×10 {	459.	{ 1 12 }	1234.4	7.08	544,370	1185.2
Ditto.	„	„	74	{ 15×10 {		{ 1 8 }				

In these trials the ploughs were drawn by four horses, but when the Dynamometer was applied six horses were used, in order that the team might be fully up to their work; the four horses had plenty to do, but the six did their work easily.

*Swing Ploughs.*—Of the two implements selected for this trial only one started, Messrs. M<sup>c</sup>Gregor and Co.'s (2934), price 6*l.* 7*s.* 6*d.* As this plough made good work, and appeared to be a strong, useful implement, we considered it deserving of the prize.

Our award was as follows:—

To Messrs. Ransome and Sims, for Wheel Plough (1764)	..	£ 7 10 0
„ M <sup>c</sup> Gregor and Co., for Swing Plough (2934)	..	7 10 0
We highly commend Messrs. Howard for Wheel Plough (1619).		
„ „ Balls, for Wheel Plough (2384).		
We commend M <sup>c</sup> Gregor and Co., for Wheel Plough (2933).		

Before leaving this part of our subject, we would direct attention to the wheel fittings and fastenings of Messrs. Seaman and Co., in which are combined, strength, simplicity of construction, and saving of friction. The straight axle used by Messrs. Ransome and Sims is also strong and simple. The result of these trials convinces us, and, we believe, the public also, that either in deep ploughing, or when the land is hard and baked, as it was at Long Benton, Wheel Ploughs are greatly superior to Swing Ploughs.

#### CLASS IV.—SUBSOIL PLOUGHS.

There were six entries in this class. After a careful trial we decided that Mr. Bentall's implement (306), price 4*l.* 4*s.*, was the most efficient, breaking up the subsoil thoroughly; and, consequently, the prize of 10*l.* was awarded to him. We also commended the plough exhibited by Messrs. Ransome and Sims (1786), as coming nearest to it in efficiency.

#### CLASS V.—PARING PLOUGHS.

There were four entries; the prize of 10*l.* was awarded to Messrs. Hunt and Pickering, for article (1669), price 5*l.* 10*s.* No premium was offered by the Society for diggers, but we believe that a really efficient implement of this kind, capable of effecting, by horse power, work similar to that known as "Smashing" by steam, would prove a boon to small occupiers. We tried five implements. Of these we highly commend *Cotgreave's Subsoil Fen-land and French Plough* (1785), price 10*l.* 10*s.*, as a most efficient implement, which tills and pulverizes the soil at one operation, and is highly valuable for a certain class of soils. We also commend *Ransome and Sims's Solid Beam Iron Plough*, V. R. (1772), price 5*l.*, as, in some measure, coming up to our idea of a digger. In connexion with this kind of work we must notice *Messrs. Hancock's Pulverizer Plough*, (2456), price 6*l.* 10*s.*, to which we awarded a silver medal. We saw this implement at work more than once; although it was not exhibited in this class.

Messrs. Hancock's idea is to produce a seed-bed at one operation; this they effect by attaching to their frame three separate cutting shares, each furnished with a short mould-board, the front share entering the soil, say 2 inches, the second four, and the third 6 inches, or in this proportion up to whatever depth the implement is set. It will be readily understood that the soil thus broken up as it were by degrees is rendered very fine and light, and the work performed was excellent. We regret that the draught of this implement was not compared with that of the ordinary plough working at the same depth.

With slight modifications, the strengthening of some parts of the implement, and the use of malleable iron shares, we believe that Messrs. Hancock will have produced an efficient "Smasher," which will prove valuable to those who cannot attain to steam cultivation. We also saw at work, and highly commended Mr. J. G. Harrison's double Mould-board or ridging Plough (3646). This implement was fitted with an improved share, to be used in ridging up stubble on strong land. We also had our attention called to a *combined Plough-Harrow and Drill*, invented by Mr. L. L. Sovereign, of Canada (2421), price 25*l.*, in which there are several points of interest and ingenuity. On light land, where a seed-bed is easily made, this may prove a useful implement.

In conclusion, we beg to tender our thanks to the stewards and their assistants (not forgetting Mr. Gibson, our field foreman, who was most attentive and active in the performance of his duties) for their attention to all our requirements, and especially for the manner in which horses were provided for the various trials, by which our work was essentially forwarded.

Signed

THOMAS P. OUTHWAITE.  
EDWARD WORTLEY.  
THOMAS P. DODS.

Newcastle-on-Tyne, July 22, 1864.

*Report of the Trial of Cultivators, Clod Crushers, Plain Rollers, and Harrows.*

We selected for trial 22 cultivators, 8 clod crushers, 17 rollers, and 41 sets of harrows, in all 88 implements; each of these had to be conveyed a distance of four miles to the trial-ground, where many of them were tried in two and several in three different fields. The time thus allowed for testing the merits of each implement was consequently very limited. The trials may thus have appeared less satisfactory than if more time could have been allowed the exhibitors to adjust and work their respective implements.

Speaking generally of the implements which came under our notice, we feel that great praise is due to the exhibitors for the great improvements which have been accomplished in their manufacture, particularly in the quality of the materials used, and the hardening the points, &c., most exposed to wear and tear. Although many of the attempts at novelty of construction may not have been so successful as could have been desired, the exhibitors show a commendable spirit in endeavouring to give practical effect to any new conception or suggestion.

The first trials coming under our consideration were the

**CULTIVATORS.**

Out of the 22 selected, 13 were tried with broadshares on a piece of foul land rendered very hard by the dry weather. Under this severe trial many of them made very fair work. These were again tried with points, along with the remaining 9, working as grubbers or scarifiers on a piece of clean fallow. Here they nearly all worked well.

The construction of these implements was very varied, no two of them being alike, so likewise was the force required to work them, which ranged from 1 to 6 horse-power. This made it a difficult task to decide on their merits; but considering that a plain, strong, simple, and well-manufactured implement was the "desideratum," we awarded a prize of 12*l.* to Mr. Bentall, 10*l.* to Messrs. Coleman and Morton, and 8*l.* to Mr. Charles Clay. We also highly commended Messrs. Coleman and Morton's cultivator for large occupiers; and commended Messrs. Corbett and Sons' implement.

**CLOD CRUSHERS.**

Eight were selected for trial in this class, being worked on a piece of rough fallow well suited for the purpose. Several of them made excellent work, and after testing the draught of four of the best of them by the dynamometer, we awarded a prize of 9*l.* to the Beverley Iron and Waggon Company, 6*l.* to Messrs. Crosskill and Sons, and 5*l.* to Mr. Cambridge; we also highly commended Messrs. Amies and Barford's implement.

**ROLLERS.**

There were 17 selected for competition, most of which showed great improvement in their construction, from the judicious substitution of wrought for cast iron both in the cylinders and frames; and also from their being made up of segments instead of one whole cylinder, a change which enables them to turn more easily, and to work much more effectually where the surface is uneven. Improvements were also made in the mode of fixing the bearings, so that they could be removed without the necessity of taking the frames to pieces.

We considered the Ballasting Rollers, exhibited by Messrs. Amies and Barford, very superior. They were entirely of wrought iron, and were composed of 2 water-tight cylinders which can be loaded at pleasure—thus securing a light and heavy roller in one implement. Our instructions only allowed us 10*l.* in this class, which we apportioned by awarding a prize of 7*l.* to Messrs. Amies and Barford, and 3*l.* to the Beverley Iron and Waggon Company. We also



highly commended the Roller No. 1986, exhibited by Messrs. Amies and Barford; and commended those exhibited by Messrs. Crosskill and Sons, Hill and Smith, and Hunt and Pickering.

### HARROWS.

There were 41 sets selected for competition, comprising all sorts of harrows for light and heavy land. This class of implement is, perhaps, more remarkable for varieties in construction than any other; besides the well-recognised zigzag harrow, they came before us under the different appellations of Combined Harrow and Scarifier, Lever, Scuffling, Rotating, Jointed, Chisel-toothed, Duck-footed, Excelsior, Flexible, Chain, Extirpator, &c.

The first trial took place on a piece of very foul land that had been broken up by the cultivators with the broadshares, and was so severe a test that very few of them could get through their task without choking. The next trial was on a piece of clean fallow which had been ploughed a few days previously. Here they all, whether designed for light or heavy land, made such good work that we found it necessary to select a few of the implements for a third trial on a piece of clover-ley which had been ploughed by steam. This answered the purpose admirably. The large number and the great variety of these implements render it impossible fully to discuss in detail, in this Report, the merits of their different modes of construction; several among them, although not mentioned in our awards, are well deserving of notice, and would prove very useful on suitable land. It being our duty to consider what implements were best adapted to the country at large, we awarded three prizes of 8*l.*, 7*l.*, and 5*l.* to Messrs. J. and F. Howard for their three sizes of harrows. We highly commended the jointed harrows exhibited by Messrs. Ransome and Sims, also the flexible or chain harrow exhibited by Messrs. J. and F. Howard, and the chain-harrow exhibited by Mr. Cambridge.

### SCHEDULE OF AWARDS.

Number of Imple- ments Tried.	Cata- logue Number.	Price of Implements.	Exhibitor's Name.	Amount of Prizes.
		£. s. d.		£.
Cultivators, 22.	308	7 7 0	Mr. Edward H. Bentall . . . .	12
	550	7 10 0	Messrs. Coleman and Morton . . .	10
	359	11 11 0	Mr. Charles Clay . . . . .	8
	554	13 10 0	Messrs. Coleman and Morton . . .	Highly Commended.
	3989	9 10 0	Messrs. Samuel Corbett and Son . .	Commended.
Clod-crushers. 8.	1404	18 10 0	The Beverley Iron and Waggon } Company . . . . .	9
	376	18 10 0	Messrs. Willm. Crosskill and Sons .	6
	1493	15 0 0	Mr. William C. Cambridge . . . .	5
	1981	18 10 0	Messrs. Amies and Barford . . . .	Highly Commended.
Rollers. 17.	1983	19 10 0	Messrs. Amies and Barford . . . .	7
	1405	15 10 0	The Beverley Iron and Waggon } Company . . . . .	3
	1986	14 0 0	Messrs. Amies and Barford . . . .	Highly Commended.
	378	11 11 0	Messrs. Willm. Crosskill and Sons .	Commended.
	643	10 10 0	Messrs. Hill and Smith . . . . .	Ditto.
	1674	10 10 0	Messrs. Hunt and Pickering . . . .	Ditto.
Harrowes. 41.	1647	4 0 0	Messrs. Jas. and Fredk. Howard . .	8
	1649	6 6 0	Ditto Ditto . . . . .	7
	1643	3 12 0	Ditto Ditto . . . . .	5
	1795	7 7 0	Messrs. Ransome and Sims . . . .	Highly Commended.
	1652	4 0 0	Messrs. Jas. and Fredk. Howard . .	Ditto.
	1498	5 0 0	Mr. William C. Cambridge . . . .	Ditto.

JOHN THOMPSON.  
JOHN HICKEN.

*Report on Miscellaneous Implements and Brick and Tile Machines. Newcastle, 1864.*

THE principal Implement-makers were well represented at this Meeting. The entries were not, however, so numerous as at Worcester, and it did not appear to us that there were many new Implements deserving of special remark; but we observed throughout the show, in various departments, many signs of progress and improvement in mechanical details. Out of 207 exhibitors, we found that Newcastle and neighbourhood, with the country to the north and west of it, included the names of 32 only. Of these, Newcastle sent 5; Northumberland, 8; Berwickshire, 2; Edinburgh and Kelso, 1; Glasgow, 1; Carlisle, 6; Ayrshire, 2; Aberdeenshire, 2; Stirling, 2; and Penrith, 3.

The Excelsior Grain Separator (No. 3 size), 1070, invented by A. B. Childs, and manufactured by Riches and Watts, is a very effective machine, combining the action of blast, riddles, and exhaust. The price is high, 40*l.*, but its great utility more than compensates for this. Having subjected the machine to the dynamometer test, we found the power consumed moderate, and accordingly awarded Mr. Childs a *Silver Medal* for this valuable machine.

The American Grist Mill (1065), price 26*l.* 10*s.*, invented by Amory Felton, of Troy (U.S.A.), and exhibited by Riches and Watts, is in our opinion the best metal mill that has yet been brought before the public. It consists of a chilled cast-iron fluted cone, working within a cylinder of the same material and shape. The arrangements for feeding the mill appear to be good. The working parts when worn out are renewable at a trifling expense. Having thoroughly tested this machine with the dynamometer, and made various experiments, we had much satisfaction in awarding it a *Silver Medal*.

Amies and Barford exhibited a fan attached to a chaffcutter, by which the cut chaff is driven through a spout in any required direction. The arrangements include the boxing up of all the working parts, which are thus preserved from dust, whilst accidents to the workmen are guarded against; to this invention we gave a *High Commendation*, believing that in many situations it may prove very useful.

In the class of Reaping and Mowing Machines there were many improvements in details, and we are led to infer that the next trial of these machines under the auspices of the Society will be attended with more than ordinary interest.

To Messrs. Burgess and Key, we awarded a *Silver Medal* for their set of draining tools, which were well made and useful.

## BRICK MACHINES.

The competitors in this class were Messrs. Whitehead, Pinfold, Sharp and Bulmer. The following table gives the results of the trials:—

Name.	Number in Catalogue.	Price of Machine.	Horse-power required to Drive Machine.	Quantity of Manufactured Clay expressed per Minute in lbs.	Quantity of Manufactured Clay expressed per each Horse-power in lbs.
Whitehead . . . .	305	£. 39	7	542·166	77·452
Pinfold . . . . .	3907	165	5	447	89·4
Sharp and Bulmer .	3900	60	Machine badly managed, and trial discontinued.		

It will be seen that of the two machines tried, Pinfold's expressed rather more clay in proportion to the power consumed than Whitehead's. The bricks produced were neither so good nor well finished; and looking at the great difference in the price of the two machines, we felt justified in awarding the

first prize of 10*l*. to Mr. Whitehead; Mr. Pinfold received the second prize of 5*l*.

**TILE MACHINES.**

Only two machines were exhibited, one by Mr. Page, and the other by Mr. Whitehead. The former not being fitted with a pulley, according to the published requirements of the Society, could not be tested, and we must leave the public to draw their own conclusions. We gave Whitehead's machine a severe trial with very inferior clay, its work was satisfactory, and we awarded it the prize of 5*l*.

*1st Experiment.*

Name.	Number in Catalogue.	Price of Machine.	Weight of Clay Screened.	Fuel.	Time in Screening.	Total Units of power expended.	Units of Power to Screen 100 lbs. of Clay.
Whitehead	295	£ 21	cwts. qrs. lbs. 7 0 0	cwts. qrs. lbs. 1 0 16	minutes. 20	69·425	10·583

*2nd Experiment.*

Name.	Net Weight of Clay Screened.	Time.	Number of Tiles, 13½ in. long.	Total Units of Power expended.	Total Units of Power for 100 ft. of Tiles.	Length of Tile made per Minute.
Whitehead	cwts. qrs. lbs. 5 3 12	min. sec. 18 30	174	55·315	28·257	feet. 10·52

W. TINDALL.  
GILSON MARTIN.

**XXIV.—*Report to the Council on the Cattle Exhibited at Newcastle.***  
By J. DENT DENT, M.P.

FOR many years the Royal Agricultural Society confined its prizes for cattle to Shorthorns, Herefords, and Devons, and placed all other established breeds together in one class. At various meetings local committees offered special prizes for breeds not distinguished by the Society, and in 1862, at the Battersea show, the Society itself extended its list of premiums to most of the established breeds of England and Wales. Last year at Worcester the Sussex cattle were thus distinguished; and this year's prize-list included special classes for Sussex, Channel Islands, Scotch Horned, Polled, and Ayrshire cattle, in addition to the class for other established breeds. It seems to me to be one of the first duties of the Society, not merely to encourage our standard breeds of cattle, but in each locality which it visits, to offer prizes that may bring out the very best specimens of the races which are found most suitable to the district; and a little care in the arrangement of the prize-list will enable us to do this without much additional

expense, or the risk of a show of inferior animals. In the present case, the Scotch classes were inadequately filled, as far as numbers go; and this may be partly attributed to the fact, that our prize-list was not advertised in the Scotch papers. I would advise that for the future the prizes which are to be given for local breeds should be made known more generally in the district, and that paying more regard to locality, we avoid giving such prizes, as for Sussex cattle in the north, or for Galloways in the south.

But while we have been doing our utmost to increase the supply of beef, by developing the meat-producing qualities of animals, I think we have been neglecting very much their milking properties. No doubt the price of beef has been steadily advancing, but so have the prices of butter and of milk. Ireland used to be a great source of supply of butter to our markets; but in that country, since 1859, the milch cows have been diminished by 295,996, and we are scarcely yet sensible of the full effect of the diminution of live stock which has there taken place;\* and in all probability the prices will rise still higher than at present. This falling off in our supplies of production is already telling on the prices of foreign butter as well as meat. The butter which in 1854 was only valued by the Customs at 4*l.* 5*s.* per cwt., has, during the last two or three years, been at 4*l.* 15*s.*, and this, too, during the period of Lancashire distress, when a large proportion of our best-consuming population was out of work; and the quantity imported, which was 425,663 cwt. in 1859, in 1863 was 986,708,† while, from the marked preference given to fresh over salted butter, we may safely infer a yet greater rise in the value of the produce of our home dairies; and, indeed, I find that the produce of my own dairy, which is bought for the Leeds market, averaged in 1852, 5*l.* 12*s.*; in 1862, 6*l.* 1*s.* 4*d.*; and in 1863, 6*l.* 10*s.* 8*d.* per cwt.

It may be no easy matter for the Society to offer prizes which shall encourage the milking properties of cattle, but I think that both breeders and judges have too much lost sight of this quality in their desire to produce the utmost symmetry of form with early maturity. The following quotation from a speech,

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\* This diminution is in no way counterbalanced by the imports of foreign stock into the United Kingdom, because while Irish stock since 1859 has been lessened by 677,323, our importations from abroad have only amounted in the same year to 546,127 head, of which one-third were calves sold for veal. The greater part of the Irish stock has come into our graziers' hands, and for the time has tended to keep down the price of lean cattle, but now that the number of reproductive animals in Ireland is so seriously diminished, our supplies both of grazing beasts and of butter must decline.

† The value of the oxen imported has risen in the same time from 14*l.* 10*s.* to nearly 17*l.* each.



made by Mr. Riley in Cheshire, tends to show the opinion which dairy farmers entertain of high-bred stock :—

“As a feeder of beef, he did not mind how nearly the cattle he purchased were related to ‘Royal Dukes’ and ‘Duchesses,’ or even to ‘Royal Butterflies;’ the nearer the better, the first cost being equal; but if he wanted milk and cheese, he would rather have his stock related to the short-legged, roomy-bodied, and rather thick-horned Cheshire cows of 1800, to the Ayrshire, or even the Welsh cow, and would prefer their being matched to the son of his neighbour’s best milking cow than to a bull of Bates’s or of Booth’s.”

We may, indeed, go further, and ask how many of our high-bred cows can rear their own calves. Beautiful as were the classes of female shorthorns at Newcastle, there was not one amongst them that we could expect to fill a pail with milk. And yet if we turn to the early history of their race, we find Mr. Bates describing one of his early cows as yielding for some months, on grass alone, butter and milk to the value of 2*l.* 2*s.* per week; and of others he speaks as having the same property to a less extent. Mr. Carr, the enthusiastic historian of the Warlaby and Killerby herds, says of one of the cows, “Satin,” that she was “all a dairyman could desire; but she was never fit to make up for show.” And of another, “Caroline:” “She was a prodigious milker, and her daughter shows what she might have been but for her accident, and her excessive addiction to milk.” Phrases like these make us almost fear that the Shorthorn breeder may look upon milking properties as a defect. But another ardent admirer of the Booth shorthorns, Mr. Storer, of Helliden, in a letter written and published whilst I was penning these remarks, says :—

“If my letter should direct the attention of Shorthorn breeders to the desirableness of doing their best to retain those milking qualities in their cattle, for which (as well as for the tendency to produce flesh) the breed has long been celebrated, I shall be satisfied.”

I cannot therefore but think, that if our great breeders had applied their energy and skill to improving the families in which these good qualities were united, we might have had Shorthorns, not perhaps so perfect in symmetry, but of a more useful character, capable of producing plenty of milk and butter, and likewise of breeding calves—which would, in due time, fill the feeder’s stall to his satisfaction.

In the north we expected a good show of shorthorns, and were not disappointed. The whole of the classes were well filled, and in male animals the show was decidedly superior to many that have gone before it. Twenty-five aged bulls were brought into the ring for the first prize. Mr. Wiley, one of the judges, describes them “as a level, good class, of great size and substance, though not containing many animals of extraordinary

merit." Mr. Parkinson says: "Every one must admit that the shorthorns were very well represented. With regard to the aged bulls, although they might be called a good class, particularly upon first sight, and probably, taken as a class, equal to former shows, still I think they were very inferior to the cows and heifers. The prize bull, No. 6, although a very fine animal of great substance and quality, with good hair and good looks, wanted the style and length of quarters so requisite for a first-class Shorthorn. We all thought him much superior to any of the rest, but very much inferior to others that have taken the same prize upon other occasions." I think the public had rather a higher opinion of them, and considered this as a remarkably even class of good animals.

There was more difference in the two-year-old bulls, who were not, with one or two exceptions, of the highest stamp. The yearlings made up a very large class, on which it was not easy to decide, and the ultimate decision gave rise to some criticism. Mr. Parkinson writes of them: "In Class 3 we had great difficulty in making our award. I now think if we made a mistake, it was in not rejecting 51, and placing No. 46 the third." Mr. Wiley merely remarks, it was a fair, good class. I think that in this and the next class, although there were not many animals of the highest style of excellence, some very good useful animals were shown, many of which were sold at satisfactory prices.

The judges and the public generally considered all the female classes good. Of the cows, Mr. Parkinson writes: "The class of cows was very good. I do not think there could be a doubt as to the prize cow being quite deserving her high station. And in giving the other prizes in that class, we showed that the high fed ones did not, of necessity, obtain prizes." This class was generally commended; and, in spite of some extravagance of feeding in all the animals, presented a very fine show of robust Shorthorns. The two judges who communicated with me, speak highly of the heifer classes, in which some of the high-priced animals of the Townley herd had to yield the pride of place; and as a proof of the general excellence of the show, Mr. Parkinson says:—"I have little to add of the heifer classes, except that they promise well to keep up the character of the show in future years. I may also say that I never saw so few inferior animals in a show-yard."

The Shorthorns came from all parts of the united kingdom, and many of the old breeders found it no easy matter to maintain their position against new rivals. The Scotch sent twenty-seven animals, and were most successful, carrying off the first and second prizes in the aged bull class, the first in the two-year old, and the second in the yearling bull classes. In the cows,

the second prize and reserve number; in two-year-old heifers the first prize, in yearlings the second, and in calves the third prizes, besides several commendations, were taken across the border. The districts of Northumberland, Durham, Westmoreland, and Cumberland furnished fifty-one animals to the show-yard, and carried off the first prize for cows, the third for bull calves, and the second for two-year-old heifers.

Before leaving the Shorthorn classes, I will venture to make one or two remarks on the present system of judging, and the criticisms which were addressed to me as steward of cattle. One suggestion made is, that the society should provide men to lead the cattle into the ring, in order to avoid the supposed partiality of judges towards the stock of particular breeders, whose herdsmen are known to them. But apart from the difficulty of finding proper persons in sufficient numbers to lead the cattle, I believe that many, if not most of our judges, know the animals themselves, certainly the older ones, just as well as racing men know the horses that are about to start for a race. For my own part, I would place a complete catalogue of the stock in the judges' hands, and trust to their sense of honour and impartiality, rather than keep our present position of supposed ignorance, which is no safeguard, but rather a screen for favouritism or incompetency. Another suggestion was made that we should increase the number of judges to five, but those who saw the judging of the horses at the Agricultural Hall by a jury of five will not readily forget the tedious process, which produced results quite as much open to criticism as the judging in our own show-yard. I feel sure that three competent men are better than more. Whilst upon this point I would urge all breeders of stock and members of the society generally, to send to the Council a good list of names of men whom they consider qualified to act as judges. The names suggested are so few, and there is so much ridiculous jealousy, that from an experience of three years I can safely say the Council has no more difficult task than the selection of judges. Surely those who neglect to send in names of competent and disinterested men are as much to blame for the difficulties which arise as the Council and those who work hard in its service.

We could not expect a numerically strong entry of either Herefords or Devons, but we had amongst those sent some very superior animals, especially in the female classes of Devons. A Hereford herdsman called my attention to one of the prize cows, which was suckling her own calf, and challenged me to bring a Shorthorn one that would do the same. In the Hereford cow and heifer classes the fault of over feeding prevails, if anything, to a worse degree than amongst the Shorthorns.

Mr. Keary has sent me the following report:—

#### HEREFORDS.

In the OLD BULL CLASS (IX.) of HEREFORDS, there were several good ones, besides the prize animals. It might be called a small but good class.

In the Second Class (X.), only three were exhibited, two of which were good ones.

The Third Class (XI.) was not a good class.

The next Class (XII.) was a bad class.

The COW CLASS (XIII.) was small. The first and second prize animals were *very good*, and there were some other good cows.

In Class XIV. (HEIFERS) there were three very good animals, including the first and second prizes.

CLASS XV. (YEARLING HEIFERS).—The prize animals were good.

CLASS XVI. (HEIFER CALVES) contained 3 pretty good ones.

On the whole the exhibition of Herefords was a very creditable one. The number in each class were small, but there were many very good animals, and but few below mediocrity.

DEVONS. CLASS XVII.—Bulls above 3 yrs. and not exceeding 6 yrs. old.

Only two exhibited. The first prize bull (219), belonging to Mr. Walter Farthing, of Stowey Court, Bridgewater, is a *very remarkable animal*, and had certainly the largest amount of flesh upon short legs of any bull in the yard; although he is apparently much too fat and heavy for a bull, we were assured by his owner, after the award was made, that he is a regular and sure stock-getter. This bull was exhibited as a calf at Leeds, where he won, and he has won first and second prizes at every meeting since.

The second prize bull (218) was not in any way remarkable.

DEVONS. CLASS XVIII.—Bulls above 2 and not exceeding 3 yrs. old.

The first prize bull (223), belonging to John A. Smith of Bradford Peverill, Dorchester, of extremely good quality of flesh, and altogether a nice animal; but his head is rather effeminate, and the masculine character not sufficiently developed.

The second prize, No. 222 (General Hood), is in some respects superior to the first prize, but inferior in quality, and not let down enough in his fore-quarters.

Only 3 animals were exhibited in this class, and the third, 224 (Mr. Walter Farthing), was considered worthy of commendation, and is no doubt an improving young bull.

DEVONS. CLASS XIX.—Bulls above 1 and not exceeding 2 yrs. old.

First prize, No. 226 (Walter Farthing), a very useful and improving young bull.

The second, No. 225 (the same owner), below mediocrity. Altogether this must be considered a bad class.

DEVONS. CLASS XX.—Bull Calves above 6 months old.

Only one calf (No. 231) exhibited, and the quality of his flesh was so extremely bad that we hesitated some time before awarding the prize.

DEVONS. CLASS XXI.—Cows above 3 yrs. old.

First prize, No. 234 (John A. Smith of Bradford Peverill, Dorchester), a very beautiful cow, and decidedly the best in her class.

Second prize, No. 237 (Walter Farthing), a very good old cow, having worn remarkably well, and carrying a great deal of good flesh on all her points.

On the whole a very good class.



DEVONS. CLASS XXII.—Heifers in Milk or in Calf.

First prize, No. 244 (Walter Farthing), not a first-class animal.

Second prize, No. 242 (Charles Hambro, of Milton Abbey, Blandford Dorset).

A small poor class, and very inferior to those of former years.

DEVONS. CLASS XXIII.—Yearling Heifers.

First prize, No. 246 (General Hood), a remarkably good heifer; perhaps the best Devon exhibited, and certainly one of the best heifers in the yard.

Second prize, No. 249 (George Turner), rather a nice heifer, but overgrown rumps for her age.

One or two more nice heifers exhibited here, and altogether a nice class.

DEVONS. CLASS XXIV.—Heifer Calves, above 6 months.

One only was exhibited, No. 251 (Walter Farthing); a good calf.

To sum up. The Devons were smaller in numbers, and, excepting a few good animals, the Show must be considered inferior to that at Worcester, and a sad falling off from Battersea. This may be accounted for perhaps by the great distance of Newcastle from the counties where Devons are chiefly bred. None of the true North Devon men, as the Quartleys or Daveys, exhibited.

SUSSEX CATTLE.

These cattle were small in number, and very inferior in quality, &c., to the Battersea Exhibition, where they cut a very good figure. The distance from home may account for the small number shown, but does not explain their great inferiority, as one would have thought that the best would be sent, and the bad ones kept at home.

H. W. KEARY.

*Bridgnorth, 26th July.*

Mr. Keary's remarks on the Sussex cattle confirm me in my opinion that it is unwise so far from home to offer prizes for any breed of cattle which have no particular merit to recommend them for adoption in other than their own locality. If the other breeds were over-fed, Sussex, at all events, were exhibited in a thoroughly natural state. The Channel Islands cattle mustered strong, when we consider the distance they had to come, and there was an excellent show of the useful red Suffolks, who deserve a better place than a class made up of themselves and the nondescript Breton race.

Although the Scotchmen failed in number in their own especial classes, Mr. McCombie may fairly boast of having shown in the Angus classes some of the best animals in the yard. In other races we in vain look for a cow who, when over thirteen, and having had a calf every year since she was two years old, can still, as his "Charlotte, No. 319," face the ordeal of a show-yard with success. Mr. Fullarton may well describe her and her daughter, as "Two uncommonly fine animals, the young cow being of the most complete symmetry;" while he says of the entries generally, "As a whole we consider the lots shown of this breed to be of great merit, more especially the bulls, cows, and yearling heifers, No 324, Mr. McCombie's yearling being a most

perfect beast.” Beautiful as Mr. McCombie’s stock are, I should like to have seen some one else enter the lists against him, and show to Englishmen that there is more than one breeder of such excellent stock.

Of Ayrshire and Horned Scotch cattle the show was but indifferent, though the judges, through Mr. Fullarton, report favourably of the Ayrshire cows and heifers, and also of the two West Highland cows belonging to the Duke of Athol.

The local committee offered prizes for Galloways, which were successful in bringing forward some good animals of the breed, the judges calling the aged bulls “a very superior lot,” and also quoting the two prize cows “as excellent specimens of the breed.” \*

I feel how very imperfect are these remarks upon the different classes, but it has been my duty rather to look at the show generally than to make individual criticisms. The cattle were admirably delivered into the yard before the opening of the show, and removed on the Friday night without trouble or confusion. When I left Newcastle on Saturday morning, at 8.30 a.m., the traffic superintendent of the North Eastern railway informed me that all the stock had been sent off during Friday night, except those whose owners wished them to remain. When I remember the confusion of Worcester, I think it only fair to place on record the superior management of the railway authorities at Newcastle.

The cattle were paraded each day in the rings, the beautiful show ground affording ample space for their display, and I believe that both to the owners of cattle and the public this parade gave unqualified satisfaction. It was carried out without any difficulty, because the herdsmen were willing and anxious to assist, and I should not do justice to them if I were not to acknowledge here their ready civility and constant attention to the wishes of myself and the other officers of the society with whom they were brought in contact. I may say the same of the yardmen employed by the society, and of our invaluable assistants, the members of the A division of police. It is very gratifying to me to report that the arrangements for fodder, and generally for the comfort of both animals and men gave general satisfaction. Although there are some trifling improvements in the shedding, which may easily be carried out at a future meeting, on the whole I feel justified in congratulating the society on a show of cattle, somewhat unequal in its component parts perhaps, but still highly instructive and satisfactory.

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\* In the cases in which I have received any written communications from the Judges, I have quoted their own words, as being preferable to any comments of my own.

*Report of the Stewards of Stock at the Newcastle Show.*

HORSES.

This part of the Show fell 37 short in its numbers as compared with last year, and, in spite of the inducements which were held out to owners of Clydesdales, only 9 entries were sent from over the Border. The whole of the entries reached 164, which were distributed into 33 classes, with three silver medals and 835*l.* of prize money. There was a very clean bill of health, as only 5—to wit, a thoroughbred sire, 2 hunters, and 2 dray-horses—were disqualified, 4 of them for roaring and the fifth for whistling.

The hunters were saddled, and ridden in the very spacious horse-ring—a novelty which gave great satisfaction. We should, however, mention that the mode adopted in the Catalogue, of keeping the Society's and the Local Committee's classes separate, was productive of a good deal of confusion to the spectators and of difficulty to the acting Steward. For the future we beg to recommend that the Thoroughbreds, Hunters, Roadsters, Ponies, and Agricultural Horses should follow each other in that order both in the Catalogue and into the ring for whatever prize they may be entered. It might also be well, after the successful experiment of this year, for the Society to permanently embody in their programme the prize for Agricultural pairs, and to have a class for Three-Year Fillies and Geldings calculated to make carriage-horses. The Pony Classes were very weak. The present standard, "not exceeding 14 hands," just excludes many of the best, but the difficulty might be met by raising it half a hand, and establishing another class for those not exceeding 13.

For the *Thoroughbred Stud-Horse* prize (Class LII.) there were only 10 entries, and "Buccaneer" did not come, in consequence of his owner, Mr. James Cookson, accepting the office of Judge. Cumberland furnished the winner in "Laughingstock," whose owners, the Messrs. Moffatt, were second to "Royal Ravenhill" for the Society's prize with "British Yeoman" at Carlisle, and won it with him the following year at Chelmsford. The winner, of whom one of the Judges says he is "as beautiful a horse as I ever saw, but not fully let down yet," is closely allied in blood to "Asteroid" and "The Marquis." He is by "Stockwell" from a "Touchstone" mare, the dam of "Gamester," and both of these horses were bred by Sir Charles Monck, of Belsay Castle, in Northumberland. But for "Gamester's" lack of knee-action, it would have been a very near point between them; but eventually the St. Leger winner was placed third, as

"Caractacus," the Derby winner, had been, a few weeks before, at the Agricultural Hall. "Cavendish," who was second to "Neville" at Worcester, when the whole class was highly commended, occupied the same position again. "He is a horse of a very beautiful colour, but he seems to be growing coarse." "Sir Walter Scott" was disqualified; and the other five, "Carbincer," "Littlecote," "Layton," "Lord Chesterfield," and "Schuloff," received no mention from the Judges.

The new rule that no horse should compete in the *Hunter Sire*, Class LIII., unless he be thoroughbred, effectually weeded out the motley lot which were entered for this prize at Worcester, while it excluded animals like "Ellicott" and "Safeguard," the very excellent second and third of last year. Only two were entered, and the first prize was awarded to "quite a quality horse," "Motley," while the second was withheld for lack of merit from "Royal Oak-Day."

Class LIV., for *Hunter Brood-Mares*, was "very ordinary." The winner, Mr. Brown's "Sally," was "rather a nice, short-legged one" from Cumberland, and, like Mr. Charles Moffatt's commended one, by "Galaor." Mr. William Scarth's mare "Plucky" was rising twenty, and still good for her years. As this prize, as well as that for Class LIII., was given by the Local Committee, "Beechwood," the winner of the first prize in the *Hunter Class* (CXXVIII.) at Worcester, was entered again,—an anomaly which might be worthy of consideration by the Council. However, his "action and quality were only ordinary," and the first prize was unanimously awarded to Sir Frederick Graham's chesnut gelding "The Tyke," "a rare galloper and mover altogether, but with less substance than 'Beechwood.'" Mr. Sutton's highly commended "Voyageur" was "light-fleshed and all muscle and wire, with hind-legs of especially beautiful quality," and the Judges also liked "Grapeshot." In fact, "there were several good weight-carrying hunters, but some of them hardly up to a fast thing with foxhounds."

The *Four Year-old Hunter*, Class CXXIX., was headed by Mr. W. H. Clark's "Sprig of Nobility," by "Sprig of Shillelagh," "a rare four year-old, master of great weight, and with depth of rib like an aged horse." The second prize was given to Messrs. Norman's "Radical," "a horse of nice quality, but too short altogether," and with the white hind-stockings which the "British Yeomans" invariably exhibit whenever they fall chesnut. Mr. Pease's "Silas Marner," who was highly commended, "had fair action, but was a little defective in his ribs."

The *Three-Year Old Hunter*, Class CXXX., brought out "a moderate lot." The first prize was given to Mr. Boyd's chesnut gelding, by "Auchinleck;" and the second to Mr. R. W. Hodg-



son's bay filly, by "Neville," and "a good goer." One of the Judges thus reviews the classes in detail:—

"As regards our particular classes, I can only say that as the object was to select a stallion best suited to improve generally the breed of horses, we were more likely to succeed in giving the prize to 'Laughingstock,' of 'Bird-catcher' type and blood, than to any other in the class. To get race-horses, I should certainly have selected 'Cavendish,' not that I quite approve of him even for this purpose: but if put to well-ribbed-up mares he may be successful.

"Thoroughbred mares from their frequent want of bone and general power may be met by a horse *often* without much quality; but the mares sent by farmers to a thoroughbred are, nine times out of ten, so lumbering and deficient in quality, that much of it is absolutely a *sine quâ non* in a travelling thoroughbred sire. Shoulders there must be, as in this point country mares are generally deficient, and as experience tells me that the external organisation is *mostly* from the horse, there is very little chance of breeding a clever horse for the road or field from a bad-shouldered stallion. In racing, shoulders may sometimes be dispensed with, as race-horses travel, so to speak, on even ground; but a hunter has to contend with all sorts of ground, and cannot extricate himself from difficulties with shoulders into his neck. The prize horse was good in this respect, and with a short back and undeniable trotting action he beat 'Gamester' who was much more my idea altogether of a horse to get hunters, but he could not either walk or trot. 'Laughingstock,' like many of the 'Stockwells,' had his hind-legs too much bent, which I think a great fault in a hunter-sire; but still, take him altogether, he was the best of the lot. Still the lot, with the exception of 'Gamester,' if he had action, was, I am certain, a bad one.

"'Cavendish,' was too heavy and coaching in his neck, and wanted another back-rib to make him *tight* enough to get hunters except out of remarkably short-backed mares. Besides this, I know every cross of big-headed 'Black-lock' to be utterly deficient in the necessary style and fashion for country purposes. I was therefore obliged to oppose 'Cavendish.' 'Voltaire,' 'Charles XII.,' 'Brutandori,' 'Hetman Platoff,' 'Barnton,' and 'Fandango' have all more or less had hunting mares put to them, and with few exceptions have signally failed. If 'Motley' had been shown for the £100 prize, he would have had a chance in such a year as this was, though he is not quite straight enough on his fore-legs, to beat a good one; still, in other respects, he has all the character of 'Touchstone,' with compactness enough to meet a country, and with good knee-action.

"Among the Hunters I thought 'The Tyke' as firm a horse as I ever saw, with undeniable hind-legs, and almost faultless in other respects; and I had the satisfaction of hearing (after our judgment was given) from a man upon whom I can rely that he was a first-rate performer in the field, and clever up and down hill.

"The winner in the Four-year-old class had very light action, and showed much blood for a big horse; but he was bigger than I liked, though our judgment has been confirmed at Middlesborough, where this class was superior to that of The Royal.

"The Three-year-old winner was the only one of his class with the slightest pretensions to ever making a hunter. The mare that was second, though very clever as far as she went, did not look like getting to size enough for the field."

The *Roaster Stallion*, Class CXXXI., was only four strong, and three of these from Yorkshire. "Venison" was "quite out

of place" amongst them, and the highly commended "Young Pretender" "had not so much quality as the winner," "President Junior," who has now taken about twenty prizes, nearly all of them firsts. One of the Judges writes thus:—

"The winner is without doubt one of the best looking Roadsters ever seen, and 'Young Pretender' nearly as good; but I beg respectfully to suggest to the Stewards whether it be desirable to encourage this class of stallion. To my mind, this is the animal we want to breed, and not to breed from; as, unless this class of horse is put to a thoroughbred mare (which we know seldom happens), he must beget something inferior to himself."

The *Roadster Mares or Geldings*, Class CXXXII., were "a fair average class, without containing anything very first rate." The winner, Mr. Richard Foster's "Multum in Parvo," an Irish-bred one, "was decidedly the best both in shape and action," and Mr. Pease's neat chesnut, "Whitefoot," was commended. There were only a couple in the *Hackney Brood Mare* Class LV., but neither of them so true a type of the sort as "Crafty," the winner of last year. One of the Judges observes:—

"This prize was for mares in foal or with a foal at their foot; and there were great doubts as to 'The British Queen' being in foal, while 'Fanny' had a foal at her foot. On this account I consider that even if the winner had only been of equal merit with her opponent, instead of being superior in shape, she would have been entitled to the prize. Both mares were good average specimens of Hackneys."

There were only three *Pony Stallions* in Class LVI., and Mr. W. Norman's chesnut, "Jack," the reserved number at Worcester, took the first prize again to Cumberland, which fairly beat Yorkshire in the non-agricultural classes. "'Jack' is of a rare stamp, with capital hock and general action, and shows considerably more breeding than the second prize pony, 'Glen-garry,' which is also from Cumberland, but of the old hairy-heeled sort, strong and useful, but deficient in quality." The third was quite unworthy of his company, as he was simply "a rich cream, with bad shoulders and no action." There were no grand Suffolk and Norfolk entries in the *Mare Ponies* (Class LVII.) this year. "The class was very moderate, and as one of the three, No. 409, was disqualified for being 2 inches above the 14 hands specified in the conditions, it only remained for us to decide between the two greys, No. 410 and No. 411, 'Beauty' and 'My Lady,' and our decision was in favour of 'Beauty' as having the best action. Both of them were the property of Mr. George Heppel Ramsay." Class CXXXIII., for *Pony Geldings*, had five entries, and of these two were not present, and "Flora" was disqualified as being of the wrong sex. "The prize-taker, 'Little Stag,' a roan of  $11\frac{1}{2}$  hands, was decidedly superior to his opponent in shape and action, while

'Dick,' a black of 37 inches, is a good specimen of a toy pony. 'Little Stag' went remarkably well." The prize for *Mountain Mare Ponies* under 13½ hands, in Class CXXXIV., was awarded to "a good-shaped, useful, flea-bitten grey, breeder and age unknown, with a good foal at her foot," and nothing to oppose her.

The agricultural horse classes were a mere shadow of their former selves, and contained comparatively few good specimens. Class LVIII., for *Agricultural Sires*, was headed by two well known prize winners, Mr. Samuel Strickland's "Lincolnshire," and Mr. Matthew Read's "England's Glory;" and the former gentleman was also at the head of the Class LIX., with his young sire, "General Garibaldi." In Class LX., for *Agricultural Mares*, Mr. J. B. Dixon's "Jolly," a Northumberland mare, with a very good colt at her foot, was first, despite the weight of eighteen years, and Mr. S. Thompson's "Diamond," a five-year-old mare, and a good prize-winner, second. One *Two-Year-Old Filly* only was entered in Class LXI.

There were only four entries for the 110*l.* devoted to "Drays" in Classes LXII.-LXV. In fact, in two of these classes, there was nothing even to claim the second prize, in a third it was withheld; and that for *Two-Year-Old Fillies* was a blank for the second time in succession. It seems quite a matter for consideration whether these classes should be continued, as they appear to answer no purpose, and under the present regulations there may be a distinction, but certainly no difference, between Dray and Agricultural Horses. The same animal is often ranked in two successive years under these two different heads.

Class CXXXV., for *Agricultural Pairs*, produced one of the nicest spectacles of the meeting, as the eight pairs were led round the ring. Mr. C. M. Palmer's very cleanly-looking grey and bay seven-year-olds, "Dick" and "Sharper," took the head prize. A very good pair of bay Clydesdale Mares, belonging to the Duke of Hamilton, were placed next to them, and Mr. A. H. Hunt's bay and black were commended. The head and only prize for a *Clydesdale Stallion*, Class LXX., was awarded to Mr. A. Grierson's "Benicia Boy," who won the 25*l.* last year as the best Clydesdale sire in the Galloway district, and was a capital specimen of this great Scottish breed. "Sir Walter Scott," the first prize winner at Battersea, and quite one of the lions of that show, was disqualified by Professor Varnell for roaring. His son, "Young Sir Walter Scott," a colt of no remarkable promise, won in the younger stallion Class.

None of Mr. Crisp's Suffolk entries arrived, and as they formed five out of the sixteen, which is five less than last year, the show of the "cherry reds" sank into very small dimensions. There were

other absentees as well as Mr. Crisp, and in the *Two-Year-Old Filly Class* (LXIX.), which produced such a wondrous baker's dozen at Battersea, neither of the two entered were forthcoming. In short, the sixteen entries on paper dwindled down to six—four stallions, two in each class, and two brood mares. Mr. E. Collingham's four-year-old stallion, "Talbot," was a compact, good sample of the breed, on sound, short legs. Sir Thomas B. Lennard's "Canterbury Mare" was a very grand mare; and Sir Edward Kerrison, who won this prize last year with "Bragg," now took the second prize with "Lady Jane."

**One of the Judges reports as follows:—**

"Class LVIII. for aged horses was the most numerously represented, but not better than all the classes ought to have been, with such liberal prizes offered. There was no difficulty in placing them. The first prize went to a fine animal, with much substance and good action; and the second to a short-legged, compact, and very active horse. The accident which happened some time ago to the latter's off fore-foot did not make any difference in his style. No. 418, 'Blooming Heather,' was neat and well proportioned, but not very large.

"Class CLIX., for two year-olds, needs but little comment, as it had only four entries. We hope they will improve as they grow older.

"Class LX. contained some very good mares. The first prize was awarded to a particularly fine mare, 18 years of age, but not looking nearly so old. We cannot help thinking that her stock have done show-yards some service. The second prize mare ran her hard, being a very clean-legged, good shaped, and strong animal, but not showing out to advantage. A very fine mare was shown without a foal. This being a class for mares and foals, she could not take a prize, though well deserving of it, and we hope to see her and her progeny at some future day.

"Classes LXII.-LXV., for drays, contained only four entries, and leave more room for regret at the little support the dray classes received than for comment on the merits of the animals, but I would not omit to mention the beautiful foal with the grey mare, No. 437.

"Class CXXXV., for pairs of mares or geldings. Amongst this local class, were many very good animals, which commanded much of the public attention, and, if such were bred in the neighbourhood, the classes for both sires and dams ought to have been better filled, more especially as we noticed the good style of horse generally used about Newcastle. Had there been three prizes instead of one, they would have fallen to highly deserving animals. The owner of the two mares, No. 527, 'Sally' and 'Maggie,' may well feel proud of them.

"Classes CXXXVI. and CXXXVII., for three year-old agricultural geldings or fillies and two year-old geldings. Only four out of the six entries put in an appearance, and these call for no particular notice; but the yearlings in Class LXXXVIII. had amongst them some very promising aspirants to fame. The first prize-taker was a very superior colt; the second, somewhat hunter fashion, but with plenty of strength, and no doubt will thicken into a first-class plough-horse. Of those not in the prize-list, No. 543, a Suffolk, deserves mention, and will most likely be heard of another day."

**Another of the Judges writes:—**

"Taking them altogether I never saw the agricultural horses so moderate, in short, not a first-class animal among them, though there were several good ones. In Class LVIII., for stallions, the first prize horse was a good one, clean and active; the second satisfactory; and the third ditto. This was the best class



that came under my notice. I really do not think the other classes worth remarking upon, except the local class for mares and geldings, which, taking them altogether, I considered good. I cannot understand why the numbers were so short in most classes, as the arrangements were first-rate, and every facility was afforded for selecting the best without any trouble. So much space is a very great advantage to the Judges."

It was very evident that the exhibition of horses, taken altogether, was not so good as it ought to have been, and not nearly equal to many of the local shows in Yorkshire and Lincolnshire—not to mention the Agricultural Hall, where 40 thoroughbred stallions, many of them very superior, 60 hunters, 20 hacks, and a great number of ponies were shown. With few exceptions this has always been the weak point in our meeting, and there must be some cause; perhaps we may profit by experience, and make improvements before the next show at Plymouth. No doubt if we wish for a good exhibition we should afford every facility to exhibitors and impose as few restrictions as possible.

The charge of 2*l.* for each horse-box is very objectionable, and has a material effect in diminishing the numbers. It is no answer to say that the horses would cost more in the town, or that formerly we did not provide boxes. It is not to be expected that any one will send a horse from a warm stable to be placed in an open shed with a thorough draught.

*Two Hunter sires!*—perhaps now we shall not insist on their being thoroughbred—of course they should have several crosses of good blood, but it cannot be right to exclude such horses as "Elcott," "Safeguard," "East Lancashire," "Grey Prince," or a host of others.

The rule that mares should either be in foal or with a foal prevents many of the best from being shown. This condition should be erased from the prize-sheet.

R. MILWARD.

#### SHEEP.

In its entries of Cotswolds, Oxford Downs, Southdowns, and Shropshires, the Newcastle Meeting was considerably below Worcester. Even Leicesters and Lincolns showed a slight decline, and so would the "Hampshire and other Short Wool" classes, if they had not been helped out by a few Holme Lacey Ryelands. Still if the distance from their peculiar localities told severely upon the display of four of the leading breeds, their deficiency (102) was more than compensated for by the entries of sheep peculiar to Scotland and the Border counties, and thus the balance against Newcastle was reduced to 32 on a total of 415.

The new requirement that all sheep exhibited should have been *really and fairly shorn bare* now first came into operation.

and its good effect was most strikingly manifest in the absence, with three exceptions, of the preposterous length of wool left upon so many animals in previous years. Still there were a few other cases open to a suspicion that the above condition had not been *literally* fulfilled, and if it be so, and any exhibitors are now congratulating themselves upon having escaped detection, they will do wisely to abstain from repeating the deception, which amounts, in fact, to a fraudulent entry, and must be so treated. Two Inspectors of Shearing were appointed by the Council, one of whom was unavoidably absent, and thus the invidious duty devolved upon Mr. Samuel Druce of Eyntham alone, who kindly, though reluctantly, undertook the task; and reports that "the requirement of the Council that all sheep shown should be bare shorn after the 1st of April has been carried out except in the case of three rams of the Mountain Cheviot Class." These animals were disqualified accordingly.

The entry of *Leicesters* (which "comprehended many grades" in Classes LXXIV.-LXXVI.), fell three short of what it was when the Society met at Newcastle eighteen years ago; but it is pleasant to note that of the four gentlemen, Messrs. Turner, R. Smith, Burgess, and Pawlett, who then took prizes for their rams in the face of a very severe competition, the only two that are alive or continue to breed "Bakewells," were in the front rank again this July. The name of Mr. Sanday, which has for many years been as closely connected with this class as that of the late Mr. Jonas Webb with the Southdowns, was absent from the catalogue at last; but the grandsire of Mr. Borton's first Prize shearling was one of his old Holmpierrepont flock. This was "a very nice sheep with a very beautiful skin," and twin to Mr. Borton's reserve number. Mr. Pawlett was second, and Colonel Inge, who was first in this class last year, took the silver medal. The rams were "a very good class," and Mr. Cresswell was first (with his reserve number at Worcester), and second, and commended as well, while the medal and the reserve number fell to Mr. George Turner. There were only five pens of shearling ewes, and Mr. Samuel Wiley, of Brandsby, the patriarch of Leicester ram-breeders since Sir Tatton Sykes died, "won after a sharp contest," with Lieut.-Colonel Inge, who took the first prize last year. Mr. Wiley's were "a very good lot with fine skins," and quite a Brandsby model pen.

*The Cotswold*, Classes LXXVII.-LXXIX., were not, as a whole, so uniform or so well got up as we have known them, and hardly so heavy in wool. Mr. Robert Garne, who took two firsts, a second, and a third last year, did not make an entry; and Mr. William Garne and Mr. George Fletcher (who was first with his shearling ewes at Worcester) were also resting on their

oars. The shearling ram entries alone on that occasion were exactly equal to the present entries in all three classes. Mr. E. Handy, who won the first ram and the second shearling prizes here in the general long wool class, in 1846, was first now with his shearling; and Mr. Beale Brown, who had the second shearling prize of last year, took first and third honours in the ram class, with two very fine sheep. The lots fell pretty equally, as Mr. J. Wells was first in his turn for the shearling ewes, and Mr. W. Lane second.

#### The Cotswold Judges Report thus:—

“The shearling rams were not so numerous nor were they so good as on former occasions. There were four fine specimens of older sheep, very large, of fine form, and well woolled; and the shearling ewes were of average merit. Doubtless, the distance prevented many from sending sheep. Among other names which we missed in the catalogue of exhibitors, and which we hope to see in the classes next year, were those of Messrs. Hewer, Fletcher, Garne, &c.”

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In the *Lincoln and other Long Wool*, Classes LXXX.-LXXXII., Mr. R. Wright (who did not exhibit last year) and Mr. T. B. Marshall were first and second respectively for shearling rams and ewes, and a pen of shearling ewes belonging to the latter gentleman again divided two of Mr. Howard's. The first prize shearling was a good one, with fine substance, and a long and thick set staple of wool. The first prize ram was a very grand sheep, girthing 6 feet, and said to have cut 19½ lbs. of wool. The second was also a very good one, with wool perhaps finer in quality, but not so thickly planted. The first pen of shearling ewes had plenty of size and nice bone, and the second and third were also gay and good.

The *Oxford Downs* (Classes LXXXIII.-LXXXV.), as is to be expected in a cross-breed of this kind, still exhibit a considerable diversity of colour in their legs and faces; but the tendency seems as much as possible towards the dark faces, and to the retention of the Cotswold top-knot. Some of them were perhaps a little too high on the leg, but it was a very fair show on the whole. Mr. George Wallis, who won all the ram prizes last year, was in equal force again, and also “skinned the lamb” in the shearling ram class. Of shearling ewes there were only four pens; the first and second prizes were awarded to Mr. Henry Overman and the Duke of Marlborough; the two other pens were highly commended, and commended. Subjoined are the Reports of the three Judges:—

“I considered the *Oxfordshire Downs* a good class, although not so numerous as last year. The shearling rams shown by Mr. G. Wallis, which obtained the first, second, and third prizes, were exceedingly good, big with fine quality,

and so were the sheep shown by that gentleman in the Class for Rams of any age."

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"Numerically speaking, neither the Oxford nor Hampshire Downs appeared in much force, which may be accounted for by the great distance of the show from the localities in which these different kinds of sheep are bred. The several classes of each kind of sheep contained specimens which fully sustained the high position they have respectively attained. The *Oxfordshire Down* shearling ram class came first under notice. The 1st, 2nd, and 3rd prize sheep of Mr. Wallis were of good formation, combining fine size with good wool. The 3rd prize sheep was a very compact, well-formed animal, and which, if its head had been more in character with the true Oxfordshire Down ram, would have been differently placed. The sheep exhibited by Mr. Bryan were strong firm-fleshed animals. Those exhibited by Mr. Charles Howard were not up to the mark for competition in a Royal Show-yard. In the class for aged rams, the prizes again fell to the lot of Mr. Wallis for sheep of much the same stamp as those exhibited by him in the shearling class. The other sheep exhibited in this class were good specimens of their kind. The class for shearling ewes did not contain a pen of any extraordinary merit. The ewes exhibited by Mr. Overman were more uniform in form and in quality of wool than those exhibited by his Grace the Duke of Marlborough, though the latter had most decidedly the preference for colour."

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We have seen a better class of shearling *Southdown* rams at previous meetings of the Society. The tails of some of them were not nicely set on, and two or three might fairly challenge the old Sussex comment "he won't do—he ties his stockings above his knee." Last year, Lord Walsingham won every prize in the ram and shearling class, and had the reserve numbers as well; but on this occasion his Lordship showed no older rams, but repeated his victories with the first and second prize shearlings, and the first prize for shearling ewes. His Lordship's first prize shearling was a very perfect sheep of his kind, but rather small. The second, which had been first at the Norfolk Show, was a larger sheep, but decidedly inferior in symmetry, as he is too high in his rumps. Mr. Rigden's medallist was very nice behind, but fails in his shoulders. Mr. Waters, who had never previously won a prize for this breed of sheep in the Society's Yard, was first in a very fair class of rams, with a very good one. It had plenty of size, and fine loins, and was full of the real Down character. A more perfect forehand has been seldom seen. The second prize was taken by a ram of Mr. Rigden's, not noticed in the shearling class at Worcester, with fine rumps, wool, and general quality. The ears of the silver medal sheep were rather too short; but he was very good and straight in the back, and very snug in front. A noted old Babraham sheep was not noticed in this class, and seemed to have lost his handle on the journey.



The shearling ewes made up a very beautiful class, and it would be difficult to find a match for the first prize pen, sent by Lord Walsingham. The Goodwood ewes were a very level lot, but not on quite so large a scale, and hardly so well got up. The four other pens, those of the Duke of Richmond, the Earl of Radnor, Lord Walsingham, and Sir Thomas Lennard, were all highly commended, and most deservedly so.

The judges of the *Shropshire* sheep, Classes LXXXIX.-XCI., who remark that "some of the breeders of pens will in future do well to pay greater regard to the appearance, the character, and the wool of their sheep," and mention ten entries sent by five different owners, have handed in the following report:—

"The *Shropshires* form, we believe, the largest of any of the Sheep classes at the Royal Meeting of the present year, the numbers entered being as follows, viz. :—

" Class LXXXIX.—Shearling Rams .. ..	46
"       XC.—Older Rams .. ..	9
"       XCI.—Shearling Ewes .. ..	10

"This number of entries we consider comparatively large, taking into consideration the distance at which the Show is held from the counties whence they sprung, and the districts where they have hitherto been best known and appreciated.

"We have great pleasure in recording our opinion that the *Shropshires* exhibited at Newcastle are, with a few exceptions, uniform in character and quality, and combine good size and weight with excellent wool-growing properties; and that they are in all respects well calculated to maintain their position as a useful and profitable breed, and to obtain the favour of those persons who study to breed an animal capable of producing at once a high-class and plentiful supply of mutton and a heavy fleece of good wool.

"We find the class much more distinctive and uniform in character than in former years, the result, no doubt, of the sheep being recognised by the Royal Agricultural Society of England, and the consequent stimulus to flockmasters to breed from pure sires, possessing natural perfections and blood of unquestionable purity.

"In making our selections, we have endeavoured to adhere to the type we consider best calculated to maintain the reputation of the breed, and to promote the advantages of sheep breeders and the public generally; and while we have kept in view the importance of producing a heavy fleece, we have not forgotten the necessity of recommending the animals most capable of producing *heavy muscular flesh*, and those best calculated in their own natures to perpetuate a symmetrical, heavy, and hardy sheep.

"We are pleased to note that the general excellence of the Class of Shearling Rams caused us much trouble in making our decisions, no fewer than 18 specimens being ordered by us into the ring to make our final selections from, and we do not hesitate in pronouncing them to be the best 18 sheep we ever saw together."

The first prize for *Shropshire* shearlings was awarded to a totally new exhibitor, Mr. E. Thornton, of Pitchford, with Mr. H. Matthews and Mr. J. Coxon second and third; and the strength of this class may be judged of from the fact that the

judges gave six high commendations, and five commendations. In the ram class of any age, Mr. John Coxon and Mr. Price William Bowen took the first and second prizes. In that for shearling ewes, the Messrs. Crane (who have won five out of six prizes during the last three years) were not in their usual form, and Mr. H. Matthews, Mr. H. Smith, and Mr. E. Holland, M.P., were the prize takers. It is worthy of remark that two Yorkshire breeders had high commendations in this and the ram class.

Of the *Hampshire and other Short Wool*, (Classes XCII. and XCIV.) the Judges report separately :—

“Although they were not so well represented in numbers, they were never surpassed in quality. The shearling ewes shown by Mr. W. B. Canning had the size of the *Hampshire Down* and the quality of the *Sussex*, and his first prize shearling ram was quite as good as his ewes. Mr. Humfrey’s shearling ewes were exceedingly good, and his first prize sheep in the class for rams of any age was never surpassed for size and quality.”

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“The *Hampshire Downs* appeared in still fewer numbers than the Oxford Downs, though the different classes contained specimens of greatly improved form and quality. The first-prize shearling ram, exhibited by Mr. Canning, is one of good form with beautiful quality of flesh and wool. The first-prize aged ram, exhibited by Mr. Humfrey, is equally remarkable for fine form (particularly about the setting on of the shoulders) and has also good quality of flesh and wool. The shearling ewe class contained three pens of extraordinary merit. I should think the pen exhibited by Mr. Canning has never before been equalled (certainly not surpassed) for colour, form, and quality of flesh and wool combined. The pen exhibited by Mr. Humfrey was very good indeed, as also the pen exhibited by Mr. King.”

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“The show of *Hampshire Downs* was very meagre as to quantity, but the quality was very good. Mr. Rawlence, who was so successful at Worcester last year (although he had entered both shearling rams and ewes), did not put in an appearance, which left the field open for Mr. W. Canning of Elston, who exhibited perfect specimens of rams and ewes, which took first prizes. Mr. Humfrey’s stock did not come up to their former excellence, and Mr. King of Beckhampton took the second prize for shearlings with a very large old-fashioned *Hampshire*—not ‘the Improved.’ Mr. Humfrey’s aged ram was a very fine specimen of what a *Hampshire* ought to be, and took second prize at Worcester last year. There were only three pens of ewes exhibited, but they were all good; Mr. Canning’s were A 1, Mr. Humfrey second, and Mr. King’s specially commended. The distance from home prevented many of the *Hampshire* flockmasters from sending their stock, but it must not be considered, from the shortness of the entries, that the interest in the breed is at all lessening, as the prices lately realised at the sales prove the contrary.”

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The competition in these classes was confined to six breeders, and one of them (Mr. J. B. Downing) entered four of his Holme Lacey flock of Ryelands, which were so successful in their special classes of last year, but they received no mention.

The Cheviots were by no means so good as we have seen them at the Highland Society's meetings, and there were no entries from Messrs. Brydon, Borthwick, and Hunter, who carried off a great majority of the prizes at Battersea. There was not a single Scottish entry in the Blackfaced classes, which were furnished by Yorkshire, Durham, Northumberland, Westmoreland, and Cumberland. The Herdwicks were pretty nearly a Cumberland class, as that county sent thirteen entries out of sixteen, but still Westmoreland and the Messrs. Browne had the best of it in the prize list.

"The kingdom of Scotland and Northumberland," as the breeders of Border Leicesters term it, did its duty very fairly. This class of sheep has been coming into repute for some years past with the English flockmasters, many of whom attend the great Kelso ram sale in September. Last year no less than 2180 rams were sold there in one day. The Border type is so marked that the Judges at once disqualified two English Leicesters which were entered in the ram class. The black spots which are discernible about the head and ears of so many of them tell of their descent from the old Teeswaters. They are small in the scrag, but have fine general substance and size, and cross well with the Lincolns and Cotswolds. They also do well on moderate land, and bear storms well at the foot of the Cheviots. It is the speciality of the ewes to be very prolific, and to "milk like goats." They are rather bare on their bellies, and have fine but rather light weighing wool. Their breeders go for open wool as much as possible, so as to correct the close coat of the Cheviots in crossing; and if there is one thing they avoid more than another it is a tendency to blueness about the head. In the prize list the Messrs. Simson were especially successful.

The Judges report as follows on these four breeds ---

"In the Class of *Cheviot* Shearling Rams there is a good entry, and the breed is well represented. The shearling ewes are also a fair lot; but the aged rams are limited in numbers, and, with one or two exceptions, only of ordinary quality.

"The *Blackfaced* breed is poorly represented in all the classes.

"The *Herdwicks* are a good lot in all the classes.

"In the *Border Leicester* classes there is a good show of shearling rams, several of which are of superior quality. In the other classes the entries are fair, but in each the breed is well represented."

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The two Wool Judges have handed in the subjoined Report:—

"In presenting their Report the Judges wish to observe that, considering the reputation of Northumberland as a wool-producing country, and its contiguity to Berwickshire, which produces the most valuable, deep-staple

wools in Great Britain, the show of wool did not equal their expectations, either as to quantity or quality.

"The class of Leicester and Border Leicester was moderate, and specimens were found which they considered were not pure Leicester, but descended from the Cheviot ewe. They would recommend the Council to have a special class for wools of mixed breeds. The single specimens of Cotswolds and Lincoln being of no merit either for breed or texture, the prizes were withheld. The Shropshire specimens were very good, and that which obtained the prize was first-rate wool, both as regards breed and quality of staple, combined with strength and cleanliness. The other descriptions being only moderately represented need no comment."

### PIGS.

In spite of the proximity of Newcastle to the great pig breeding districts of the West Riding, the entries under this head showed a decrease of twenty as compared with Worcester. The local committee gave no prizes, but the deficiency was mainly to be found in the small white and Berkshire classes, which far more than counterbalanced an increase of one-third in the large whites.

Class CI., for *Large White Boars*, was better than last year, and there were more of them. The first prize, Mr. H. Harrison's "Young Hero," from a sow of Mr. Wainman's breed, wanted a little more hair, but was an easy winner. He is a very good and level pig, with great width between the ears and over the shoulders, and remarkably well filled up about the head. Mr. Duckering's "Victor," the second prize taker, had no tail to speak of; which is too often the first symptom of in and in breeding.

The *Small White Boars* made up a very good class (CII.), but smaller than last year, when Mr. Mangles had six entries, and was third with "Cupid." This gentleman now wins with Cupid's own brother, "Brutus," which was then the reserve number, and has grown into a very excellent pig, both in flesh, form, and hair. Mr. Findlay, of Easterhill, was second with "George I.," a good thick-fleshed pig, and Mr. Stearn third with "Young Duke," which was very much younger than either.

Among the *Small Black Boars* (Class CIII.) there was rather a tendency to be short of hair, a want which the profusion of black essence with which they are covered can hardly be said to supply. The hair of both Mr. Sexton's "General Peel" and his "Blair Athol," the first and second prize winners, both of them by "Battersea Prince," was perhaps a little too coarse. The former had a fine outline, but the latter fails slightly behind the shoulder. Mr. Stearn's "Sambo" was softer in the hair, but there was too little of it.



The *Berkshire Boars* (Class CIV.) were very inferior in every way to those shown at Worcester, and Messrs. Hewer and Joyce, who contributed ten out of twenty-three entries on that occasion, were conspicuous by their absence. The Rev. H. G. Baily won both the first and second prizes, as Mr. Hewer did last year. The first was a fair, useful pig, and the second had not a particularly nice head, and was rather slack behind the shoulders, and narrow between the ears. Mr. A. Stewart's "Garibaldi" was only seven months old, but his quality and symmetry were remarkably good, and he well deserved the silver medal.

Class CV., for *Middle Boars*, was as short in numbers as it was last year, when Mr. Wainman won with "The Nabob." This gentleman (who took five first and two second prizes) won again with "Perfect Cure," by "King Cube," the Worcester first prize winner in the small white boar class. "Perfect Cure" has a rare back, good hair, and hams fully suggestive of his name. Mr. C. W. Graham's "Pride of Leeds" again holds the second place; but he does not fill all his points so well as the winner, and is hardly so straight in his back or so wide below.

The *Large White Sows* made up a good level class (CVI.) of thirteen, or six more than last year, when it was won by Mr. Wainman's "Fresh Hope," whose hams when she was killed in the spring weighed 94lbs. each. Mr. Wainman was first and second with two very deep sided and short legged sows, "Rival Duchess," and "Rival Hope." The former, which won at Hamburg last year, was the youngest by six months, and was in better bloom; while the latter, as well as the medallist, Mr. J. Hickman's "Young Princess," had a litter of pigs at her teat.

The *Small White Sows* were a capital class (CVII.), though Mr. Crisp, who was first in this as well as three other classes at Worcester, did not send any of his entries. Mr. Wainman's "Silver Branch," a wide, deep sow, of great activity, and with capital hair, took the first prize, but her appearance rather suffered from her being so heavy in pig. The second prize taking sow, Mr. Stearn's "Victoria II.," which was also second at Worcester through the disqualification of Sir Edward Kerrison's "Annie Laurie," had a rare lot of pigs at her side. Mr. Findlay's third prize sow, "Lady Emily," by his "George I.," was very symmetrical in her back, but perhaps rather wanted depth; and Mr. Hatton also exhibited two good ones, "Queen of the West" and "Reine de Flora."

A good Class (CVIII.), of *Small Black Sows* was headed by Mr. Sexton's "Breeze," own sister to his "General Peel," a sow of very true proportions, well backed up by Mr. Stearn's "Queen

of Oude," and "Aunt Chloe," the latter of which was perhaps a little light in the poll.

Class CIX., for *Berkshire Sows*, contained several specimens rather too high in the back, and deficient in the filling up of the jowl. There was only one entry (which received a high commendation) instead of five, as at Worcester, from the Royal Agricultural College; and Mr. Joyce's absence from the ranks was hardly compensated for by Mr. Wainman, who showed Berkshires for the first time. "Dido" and "Mrs. Gamp," two very clever sows, the property of Mr. Arthur Stewart, were first and second, and Mr. G. M. Allender's "Topsy," which took the third prize by lapse at Worcester, now held that place on her own account. The winners were decidedly "Improved Berkshires," but still the class fell short of the very excellent one of last year.

There were again exactly eleven entries in Class CX. for *Sows of the Middle Breed*. Mr. Wainman was first and second, with "Northern Garland" and "Happy Link," which were somewhat difficult to divide. Both of them were rather short of hair, but especially beautiful in their bone. "Happy Link" was second last year, but was disqualified in consequence of having her first litter of pigs nineteen days too soon, and her next eleven days too late; and hence "Lucky Link," another of Mr. Wainman's, succeeded to her prize. Mr. H. Reynolds's "Dewdrop," by "Pride of Leeds," the reserve number of last year, took the silver medal.

We now come to the pens of young breeding sows. Mr. Wainman was first in the *Large Whites*, Class CXI., with a middling lot, very unlike his "Advance Symmetry," "Advance Quality," and "No Surrender," of last year.

For the *Small Whites*, Class CXII., there were only two entries. Lord Wenlock's had quite as good, if not better quality than Colonel Pennant's first prize pen, but their hams were lighter, and they did not stand so well on their legs. Mr. Sexton's "Three Graces," from his Battersea first prize sow, won easily in Class CXIII. for *Small Blacks*. Mr. Tombs and Mr. Druce were first and second in Class CXIV. for *Berkshires*, with pretty fair pens, which can hardly be said for Class CXV., and its sows of the *Middle Breed*. On the whole, it was a fair average show of pigs, but not up to the level of Leeds, Battersea, or Worcester.

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XXV.—*Report of Experiments on the Growth of Wheat for 20 Years in succession on the same Land.* By J. B. LAWES, F.R.S., F.C.S., and J. H. GILBERT, Ph. D., F.R.S., F.C.S.

[Continued from Page 145.]

II. EFFECTS OF THE UNEXHAUSTED RESIDUE FROM PREVIOUS MANURING UPON SUCCEEDING CROPS.

WHEN the same crop has been grown for many years in succession on the same land, in some cases with a change of manures, and in others with the same manure year after year, it is obviously essential to a right interpretation of the results obtained, carefully to consider the effects of the unexhausted residue from previous manuring upon the succeeding crops. The questions of the permanency of effect of different manures, and of the tendency to exhaustion which partial manuring may induce, are, moreover, of great practical importance, and are frequently discussed by practical men.

These questions cannot, however, be satisfactorily dealt with without such evidence as the accurate record of the amounts of produce obtained year after year, on the application of manures of known description and amount, can alone afford. The results of the experiments which form the subject of this Report obviously provide data well fitted to aid the elucidation of some of the important points involved. The subject is necessarily one of detail, requiring analytical as well as field results for its full consideration; but it will be here treated of by reference to the field results alone, and only so far as may be necessary to aid the proper interpretation of the results themselves, and to give some indication of their bearings upon the important practical questions—on the one hand of accumulation, and on the other of exhaustion.

The results first adduced will illustrate more particularly the effects upon succeeding crops of an accumulated residue from previous nitrogenous manuring.

In the first year of the 20 of the experiments, plot 4 was manured with the ashes of farmyard-dung, and gave no increase of produce whatever; during the next 7 years it was manured with superphosphate of lime and sulphate of ammonia, the latter in amount averaging about 277 lbs. per acre per annum; and throughout the subsequent 12 years it received no manure whatever. Table XXIII. shows the produce and increase obtained during the 7 years of the application of the artificial manures, and also during the succeeding 12 years under the influence of the previous heavy cropping, and of the unexhausted residue of the previous mineral and ammoniacal manuring:—

TABLE XXIII.—PRODUCE and INCREASE of WHEAT obtained during 7 Years of the application of Phosphatic and Ammoniacal Manure, and during the 12 succeeding Years without Manure.

Plots.	MANURES, &c.	7 Years, Manured. 1845—1851.		12 Years, Unmanured. 1852—1863.	
		Total.	Average Annual.	Total.	Average Annual.
Dressed Corn, per Acre ; in Bushels and Pecks.					
4	Superphosphate of Lime, & Sulphate) of Ammonia, annually, for 7 years)	193 0	27 2 $\frac{1}{4}$	203 1 $\frac{3}{4}$	16 3 $\frac{3}{4}$
3	Continuously unmanured .. ..	123 2 $\frac{3}{4}$	17 2 $\frac{3}{4}$	185 3 $\frac{1}{2}$	15 2
	Increase .. ..	69 1 $\frac{1}{4}$	9 3 $\frac{1}{2}$	17 2 $\frac{1}{4}$	1 1 $\frac{3}{4}$
Weight per Bushel of dressed Corn, lbs.					
4	Superphosphate of Lime, & Sulphate) of Ammonia, annually, for 7 years)	..	61·2	..	57·2
3	Continuously unmanured .. ..	..	60·2	..	56·5
	Difference .. ..	..	1·0	..	0·7
Total Corn, per Acre ; lbs.					
4	Superphosphate of Lime, & Sulphate) of Ammonia, annually, for 7 years)	12,786	1827	12,858	1072
3	Continuously unmanured .. ..	8,037	1148	11,567	964
	Increase .. ..	4,749	679	1,291	108
Total Straw (and Chaff), per Acre ; lbs.					
4	Superphosphate of Lime, & Sulphate) of Ammonia, annually, for 7 years)	20,620	2946	20,783	1732
3	Continuously unmanured .. ..	12,799	1828	19,940	1662
	Increase .. ..	7,821	1118	843	70
Total Produce (Corn and Straw), per Acre ; lbs.					
4	Superphosphate of Lime, & Sulphate) of Ammonia, annually, for 7 years)	33,406	4773	33,641	2804
3	Continuously unmanured .. ..	20,836	2976	31,507	2626
	Increase .. ..	12,570	1797	2,134	178

After the ashes of farmyard-dung had been used without giving any increase, the phosphatic and ammoniacal manuring gave,



during the 7 years of its application, a total increase of about 69½ bushels of dressed corn, and 7821 lbs. of straw; or an average annual increase of nearly 10 bushels of dressed corn, and 1118 lbs., or about half a ton of straw. These amounts would remove from the land only about one-third of the nitrogen, and one-seventh of the phosphoric acid supplied in the manure; to say nothing of the phosphoric acid, and all other mineral constituents, supplied in the first year of the experiments (1843-4) in the form of the ashes of farmyard-dung. Yet the total amount of increase obtained during the next 12 years, due to the large residue from the previous manuring, was only 17½ bushels of corn, and 843 lbs. of straw, or of corn about one-fourth and of straw about one-ninth as much as that yielded during the seven years of the application of the phosphate and ammonia. The average annual increase over the 12 years amounted to less than 1½ bushel of dressed corn and to 70 lbs. of straw.

This experiment was arranged for the purpose of determining whether during the later years there would be a less produce than on the continuously unmanured plot, indicating exhaustion of the available alkalies and silica during the 7 years of forcing by the application of other constituents to their exclusion; or whether there would be an increase, due to the accumulation in the soil of nitrogen and phosphoric acid, in which case it might be concluded that there was, as yet, no deficiency of available alkalies and silica in the soil, relatively to the annually available supplies of nitrogen from natural sources. The latter proved to be the case. In fact, there is no doubt that the farmyard manure ashes applied in the first year, would supply at any rate considerably more potass than was removed by the increased produce during the next 7 years. It will perhaps be objected, that the increase would have been much greater, both during and after the 7 years, had fresh supplies of alkalies been provided. Under the conditions of the experiment, such as they were, however, the unexhausted residue of previous manuring was obviously very slowly available in succeeding seasons.

Again, to a portion of the experimental plot 3, from which 12 unmanured crops of wheat had been taken—a kind of treatment which it has been alleged by Baron Liebig would bring our soil into such a condition of exhaustion of available mineral constituents that it would yield no increase on the application of ammonia-salts alone—a dressing of these salts was applied in the 13th season, and then 7 crops were taken without further manure, in order to trace the degree or limit of the effect of the unexhausted residue of nitrogen supplied. The results are given in the following Table (XXIV.):—

TABLE XXIV.—PRODUCE and INCREASE of WHEAT, both in the Year of Application, and during the 7 succeeding Years, by the use of Ammonia-salts alone for 1 Year after 12 Crops without Manure.

Plots.	MANURES, &c.	1 Year, Manured (after 12 Unma- nured). 1856.	Total, 7 Years Unma- nured. 1857— 1863.
Dressed Corn, per Acre; in Bushels and Pecks.			
3a	400 lbs. Ammonia-salts for 1856, afterwards unmanured	28 0 $\frac{3}{4}$	115 0 $\frac{3}{4}$
3	Continuously unmanured .. .. .	14 2	113 2 $\frac{3}{4}$
	Increase by Ammonia-salts .. ..	13 2 $\frac{3}{4}$	1 2
Weight per Bushel of Dressed Corn; lbs.			
3a	400 lbs. Ammonia-salts for 1856, afterwards unmanured	56·3	..
3	Continuously unmanured .. .. .	54·3	..
	Increase by Ammonia-salts .. ..	2·0	..
Total Corn, per Acre; lbs.			
3a	400 lbs. Ammonia-salts for 1856, afterwards unmanured	1759	7138
3	Continuously unmanured .. .. .	892	7025
	Increase by Ammonia-salts .. ..	867	113
Total Straw (and Chaff), per Acre; lbs.			
3a	400 lbs. Ammonia-salts for 1856, afterwards unmanured	3052	11,836
3	Continuously unmanured .. .. .	1558	11,448
	Increase by Ammonia-salts .. ..	1494	388
Total Produce (Corn and Straw), per Acre; lbs.			
3a	400 lbs. Ammonia-salts for 1856, afterwards unmanured	4311	18,974
3	Continuously unmanured .. .. .	2450	18,473
	Increase by Ammonia-salts .. ..	2361	501

Thus, 400 lbs. of ammonia-salts per acre, applied on land which had grown turnips, barley, peas, wheat, and oats since manuring, and then 12 crops of wheat without manure, and applied, more-

over, in a season of inferior grain-producing quality, gave in the year of the application an increase of about  $13\frac{1}{2}$  bushels of dressed corn, and 1494 lbs. or rather more than  $13\frac{1}{2}$  cwt. of straw. This amount of increase would, however, carry off only about one-fourth of the nitrogen supplied. Yet the total increase obtained without further manure during the 7 succeeding years, was only  $1\frac{1}{2}$  bushel of dressed corn, and 388 lbs., or about  $3\frac{1}{2}$  cwt., of straw. Here again, then, the residue of the previous nitrogenous manuring was but very slowly, and very partially, recovered in the succeeding crops.

It may, of course, be alleged against this experiment, that the want of effect of the residue of the previous nitrogenous manuring was due to the exhaustion of mineral constituents. The experiment next considered is less open to this objection.

Plot 5 was variously, but liberally, manured during the first 8 years of the experiments. During that period, considerably more nitrogen, more than twice as much potass and phosphoric acid, and probably more of every other mineral constituent, except silica, had been applied in the manures than was taken off in the total produce; and very much more, therefore, than was contained in the increase of produce. In each of the 12 succeeding years, a mixed mineral manure, supplying liberally potass, soda, magnesia, lime, sulphuric acid, and phosphoric acid (but no silica), was applied. Table XXV. (over leaf) shows the results obtained during these 12 years.

It is seen that the total increase obtained during 12 years by the annual use of a liberal mixed mineral manure, succeeding 8 years of accumulation of nitrogen and mineral constituents, was only about  $35\frac{1}{2}$  bushels of dressed corn, and 2827 lbs., or about  $25\frac{1}{2}$  cwt. of straw; equal to an average annual increase of less than 3 bushels of dressed corn, and little more than 2 cwt. of straw.

The question arises—is this amount of increase due to the mineral manures applied during the 12 years of its production, or is the whole, or part of it, to be attributed to the previous accumulation? Doubtless part is due to previous accumulation, and part only to the direct effect of the newly-supplied mineral manure in enabling the plant to avail itself more fully of the natural supplies of the soil and season. Even were nearly the whole attributable to accumulation of nitrogen previously supplied, the amount is very small compared with that from direct nitrogenous manure. In fact, the limit of the effect of the unexhausted residue from the nitrogenous manuring of the earlier years is seen to be such, that it is obvious the average results of the different manures over the last 12 years, may, in most cases, be

TABLE XXV.—PRODUCE and INCREASE of WHEAT obtained during 12 Years with Mixed Mineral Manure, after 8 Years of liberal Nitrogenous and Mineral Manuring.

Plots.	MANURES, &c.	12 Years, 1852—1863.	
		Total.	Average Annual.

## Dressed Corn, per Acre ; in Bushels and Pecks.

5	Mixed Mineral Manure alone, every year .. .. .	221 0 $\frac{3}{4}$	18 1 $\frac{3}{4}$
3	Unmanured, every year .. .. .	185 3 $\frac{1}{2}$	15 2
	Increase .. .. .	35 1 $\frac{1}{4}$	2 3 $\frac{3}{4}$

## Weight per Bushel of Dressed Corn ; lbs.

5	Mixed Mineral Manure alone, every year .. .. .	..	57·9
3	Unmanured, every year .. .. .	..	56·5
	Increase .. .. .	..	1·4

## Total Corn, per Acre ; lbs.

5	Mixed Mineral Manure alone, every year .. .. .	13,888	1157
3	Unmanured, every year .. .. .	11,567	964
	Increase .. .. .	2,321	193

## Total Straw (and Chaff), per Acre ; lbs.

5	Mixed Mineral Manure alone, every year .. .. .	22,767	1897
3	Unmanured, every year .. .. .	19,940	1662
	Increase .. .. .	2,827	235

## Total Produce (Corn and Straw), per Acre ; lbs.

5	Mixed Mineral Manure alone, every year .. .. .	36,655	3054
3	Unmanured, every year .. .. .	31,507	2626
	Increase .. .. .	5,148	428



taken as sufficiently nearly indicating their comparative effects in a practical point of view.

If, however, the increase on plot 5 during the 12 years is to be referred in any great part to previous accumulation, what an insignificant amount remains as the effect of the mixed mineral manure in restoring the productiveness of the wheat-exhausted soil. It will, perhaps, be said that it would have been greater if silica in an available form had also been supplied. Baron Liebig has, however, maintained that, provided there be a sufficiency of available alkali in the soil, there will never be a deficiency of available silica. Our own analytical results do not justify this conclusion in all its fulness. At the same time, it may be stated that the mixed mineral manure employed did supply a great excess of available alkali; and that when to the same mineral manure 400 lbs. of ammonia-salts were annually added there was a further annual increase of nearly 18 bushels of dressed corn, and nearly 20 $\frac{1}{2}$  cwts. of straw, notwithstanding the exclusion of silica from the manure.

The next selection of results affords even more direct and more striking evidence of the comparatively small immediate effects of the supposed unexhausted residue from previous nitrogenous manuring.

During the first 8 years of the experiments, plots 17 and 18 received much about the same amounts of nitrogen, potass, and phosphoric acid, and yielded about the same amounts of total produce as plot 5; plot 18, however, received rather less than the others. The accumulation of nitrogen and mineral constituents was, in fact, practically very nearly the same on all 3 plots. From this time, instead of receiving mineral manure every year as plot 5, each of the other two plots (17 and 18) received ammonia-salts and mixed mineral manures alternately. In other words, when plot 17 was manured with ammonia-salts, plot 18 was manured with the mixed mineral manure, and *vice versâ*; so that, each year, the one had ammonia-salts immediately succeeding the mixed mineral manure, and the other the mixed mineral manure immediately succeeding ammonia-salts. The detailed results of this most interesting experiment are recorded in the Appendix Tables, and some of them are exhibited in the coloured diagram No. II. (facing p. 461), to which reference will be made further on. But the point to which attention is now to be particularly directed is the amount of increase obtained when the mixed mineral manure each year succeeded ammonia-salts, as on plots 17 or 18, compared with that obtained when the same mixed mineral manure was employed year after year on the same plot, as on plot 5. Table XXVI. illustrates this point:—

TABLE XXVI.—PRODUCE of WHEAT by Mixed Mineral Manure each Year succeeding Ammonia-salts, compared with that by Mixed Mineral Manure Year after Year.

Plots.	MANURES, &c.	12 Years, 1852—1863.			
		Total.		Average Annual.	
Dressed Corn, per Acre; in Bushels and Pecks.					
17 or 18	Mixed Mineral Manure, each year succeeding) 400 lbs. Ammonia-salts .. .. .	225	3½	18	3¼
5	Mixed Mineral Manure, every year .. .. .	221	0¾	18	1¾
	Increase .. .. .	4	2½	0	1½

## Weight per Bushel of Dressed Corn; lbs.

17 or 18	Mixed Mineral Manure, each year succeeding)	..	58·0
	400 lbs. Ammonia-salts .. .. .		
5	Mixed Mineral Manure, every year .. .. .	..	57·9
	Increase .. .. .	..	0·1

## Total Corn, per Acre; lbs.

17 or 18	Mixed Mineral Manure, each year succeeding)	14,177	1181
	400 lbs. Ammonia-salts .. .. .		
5	Mixed Mineral Manure, every year .. .. .	13,888	1157
	Increase .. .. .	289	24

## Total Straw (and Chaff), per Acre; lbs.

17 or 18	Mixed Mineral Manure, each year succeeding)	23,823	1985
	400 lbs. Ammonia-salts .. .. .		
5	Mixed Mineral Manure, every year .. .. .	22,767	1897
	Increase .. .. .	1,056	88

## Total Produce (Corn and Straw), per Acre; lbs.

17 or 18	Mixed Mineral Manure, each year succeeding)	38,000	3166
	400 lbs. Ammonia-salts .. .. .		
5	Mixed Mineral Manure, every year .. .. .	36,655	3054
	Increase .. .. .	1,345	112

Assuming, as doubtless was the case, that at the commencement the 3 plots were practically in very nearly the same condition of productiveness, it might be supposed that the mixed mineral manure applied each year after ammonia-salts, as on plots 17 or 18, thus providing the most favourable conditions for the productive effect of the unexhausted nitrogenous residue, would give a considerable increase beyond that on plot 5, where the mineral manure each year succeeded mineral manure. Table XXVI. shows, however, that plots 17 or 18 gave annually only about  $\frac{1}{2}$  bushel of corn, and  $\frac{3}{4}$  cwt. of straw more than plot 5. Yet the average increase obtained in the years of the application of the ammonia-salts on plots 17 or 18, though always succeeding the mineral manure, would carry off little more than one-third of the nitrogen supplied; whilst, as the next Table (XXVII., p. 458) shows, this increase was considerably less than when the ammonia-salts were used in conjunction with, instead of in succession to, the mixed mineral manure.

Thus, in the course of 12 years, an annual supply of 400 lbs. of ammonia-salts, each year succeeding the mixed mineral manure, gave 45 bushels less corn, and 5475 lbs., or nearly 49 cwts., less straw, than the same amount of ammonia-salts used each year in conjunction with the mixed mineral manure—being an average annual deficiency of about  $3\frac{1}{2}$  bushels of corn, and rather more than 4 cwts. of straw, where the ammonia-salts were used in the year after, instead of with the mineral manure. Even adding the average annual increase (over the unmanured produce) by the ammonia-salts succeeding the mineral manure, to that by the mineral manure succeeding the ammonia-salts, the amount scarcely reaches that obtained where the two manures were used in conjunction. That is to say, the influence of the mineral manure succeeding the ammonia-salts seems to have been to render practically available, at any rate no more of the unrecovered residue of the supplied nitrogen than brought up the increase in two years to that attainable in the one year when the two manures were used together, the whole of the remainder being still unaccounted for, so far as the immediate increase of crop is concerned.

The facts brought to view in the last five Tables (XXIII.—XXVII.), are of great scientific interest, and of great practical importance.

It has been alleged by Baron Liebig that, in some of our experiments, there has been so much more nitrogen annually applied in manure than taken off in the increase of crop, that after a few years the increase obtained on a further addition was not at all due to the new supply, but would have been the same without it,

TABLE XXVII.—PRODUCE of WHEAT by Ammonia-salts each Year in conjunction with the Mixed Mineral Manure, compared with that by Ammonia-salts each Year succeeding the Mixed Mineral Manure.

Plots.	MANURES, &c.	12 Years, 1852—1863.	
		Total.	Average Annual.
Dressed Corn, per Acre ; in Bushels and Pecks.			
7	400 lbs. Ammonia-salts and Mixed Mineral Manure, every year .. .. .	436 2	36 1½
17 or 18	400 lbs. Ammonia-salts, each year succeeding Mixed Mineral Manure .. .. .	391 1¾	32 2½
	Difference .. .. .	45 0½	3 3
Weight per Bushel of Dressed Corn ; lbs.			
7	400 lbs. Ammonia-salts and Mixed Mineral Manure, every year .. .. .	..	58·4
17 or 18	400 lbs. Ammonia-salts, each year succeeding Mixed Mineral Manure .. .. .	..	58·7
	Difference .. .. .	..	0·3
Total Corn, per Acre ; lbs.			
7	400 lbs. Ammonia-salts and Mixed Mineral Manure, every year .. .. .	27,306	2275
17 or 18	400 lbs. Ammonia-salts, each year succeeding Mixed Mineral Manure .. .. .	24,652	2054
	Difference .. .. .	2,654	221
Total Straw (and Chaff), per Acre ; lbs.			
7	400 lbs. Ammonia-salts and Mixed Mineral Manure, every year .. .. .	50,539	4212
17 or 18	400 lbs. Ammonia-salts, each year succeeding Mixed Mineral Manure .. .. .	45,064	3755
	Difference .. .. .	5,475	457
Total Produce (Corn and Straw), per Acre ; lbs.			
7	400 lbs. Ammonia-salts and Mixed Mineral Manure, every year .. .. .	77,845	6487
17 or 18	400 lbs. Ammonia-salts, each year succeeding Mixed Mineral Manure .. .. .	69,716	5809
	Difference .. .. .	8,129	678



by virtue of the large accumulation within the soil from the previous manuring. The results adduced show that there is no foundation in fact for this assumption.

It is demonstrated that, of the nitrogen supplied in manure for wheat, and not removed in the immediate increase of crop, so much as remains in the soil is in such a state of combination, or distribution, as to be extremely slowly recoverable by succeeding crops of the same description. How far such residue would be more rapidly available to a succession of crops of different descriptions, taking different ranges within the soil, and having different habits, and requiring different conditions, of growth in other respects, is a very important question, both in a scientific and practical point of view. It would be impossible to consider adequately in this place the evidence in our possession bearing upon this point; but it may be remarked, in passing, that it is in favour of the supposition that other plants grown in alternation with the cereals do gather up, within a given time, more of the nitrogen supplied for, but unused by, the latter, than a succession of them would do; and even barley seems capable of utilizing, within a given time, a much larger proportion of the nitrogen of manure not recovered in the immediate increase of the crop than wheat.

Although the excess of the nitrogen supplied in the manure beyond that taken off in the increase of the crop for which it was applied had such little influence upon the next succeeding crop, analysis of the soils from several of the experimental plots has shown that there is an accumulation of nitrogen in some form. Nor can there be any doubt that, except in special cases, soils become richer rather than poorer in nitrogen in the course of cultivation; showing a gradual accumulation of nitrogen beyond that annually available for the crops. In illustration, it is sufficient to refer to the fact, that the percentage of nitrogen in surface-soils is found to be much higher than in the subsoils on which they rest; that is to say, it is the higher the more they are exposed to the contact of the roots, the débris of the crops, the manure, and the atmosphere.

Leaving out of consideration the question whether or not there is an actual loss of a portion of the nitrogen supplied in the manure, either through the agency of the growing plant, or from the transformation of nitrogenous compounds within the soil, and evaporation in some form, or drainage beyond the reach of the roots, the obvious practical conclusion from the results hitherto adduced in this Section is, that, of the nitrogen supplied in manure for the growth of wheat, a large proportion remains unrecovered as increased yield in the immediate crop, and

is but very slowly, if ever fully, recovered in succeeding crops.

The next question to consider is, the degree, or limit, of effect on succeeding crops, of the unexhausted residue of *mineral* manures. This point is illustrated in a very interesting manner in the coloured diagrams (I. and II.) facing p. 461.

The results obtained on plots 3, 10*a*, and 10*b*, to which diagram I. relates, will be first noticed. The diagram, which will be easily understood on inspection, shows at one view the general character of the manuring, and the bushels of corn obtained per acre, on each of the plots, in each of the 20 years of the experiments (harvests 1844-1863 inclusive); and the following is a more detailed description of the experiments and their results:—

Plot 3 was unmanured throughout the 20 years, and during several previous seasons.

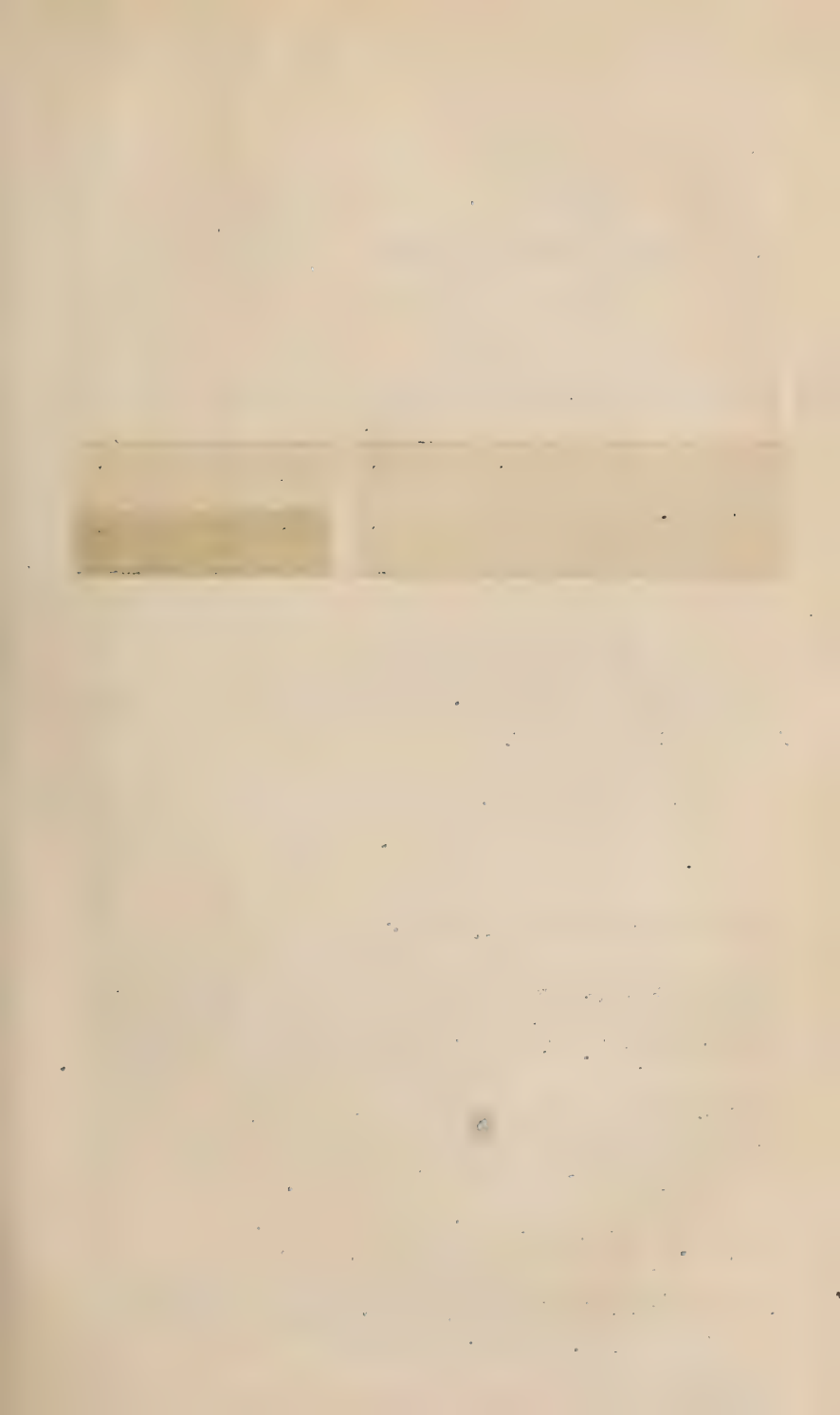
Plots 10*a* and 10*b* had the same mineral manure in the first year (1843-4). 10*a* had ammonia-salts in each of the 19 succeeding years. 10*b* had the same amounts of ammonia-salts in 17 out of the 19 years; in the 3rd year of the experiments (1846) it was left unmanured, in the 5th (1848) it had mixed mineral manure with the ammonia-salts, and in the 7th (1850) mixed mineral manure alone.

The following Table shows the total amounts of the different manures applied per acre on each of the two plots (10*a* and 10*b*) during the 19 years, 1845-1863 inclusive:—

TABLE XXVIII.

						Plot 10 <i>a</i> .	Plot 10 <i>b</i> .	10 <i>a</i> over or under 10 <i>b</i> .
						lbs.	lbs.	lbs.
Sulphate of Ammonia	..	..	..	..	..	3692	3268	+424
Muriate of Ammonia	..	..	..	..	..	3468	3268	+200
Bone-ash	..	..	..	..	..	..	400	-400
Sulphuric Acid (Sp. gr. 1.7)	..	..	..	..	..	..	300	-300
Pearl-ash	..	..	..	..	..	..	600	-600
Soda-ash	..	..	..	..	..	..	400	-400
Sulphate of Magnesia	..	..	..	..	..	..	200	-200

In the 1st year (1843-4), although the land was in that state of practical exhaustion consequent on the removal of turnips, barley, peas, wheat, and oats since the last application of farmyard-manure, plots 10*a* and 10*b*, manured with silicate of potass and superphosphate of lime, gave less than half a bushel of dressed corn, and only 77 lbs. of total produce more, per acre, than the unmanured plot (3).



# EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF WHEAT YEAR AFTER YEAR ON THE SAME LAND.

DIAGRAM 1.—Showing the effects of Ammonia-salts Year after Year, alone, and with occasional Mineral Manure, &c.

Plots.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	AVERAGE ANNUAL. 19 YEARS, 1845-63		
																						Produce.	Increase.
DRESSED CORN per Acre, in Bushels and Pecks.																							
3	15 0	23 0½	17 ¾	16 ¾	14 3	19 1	15 ¾	15 ¾	13 ¾	5 ¾	21 0¼	17 0	14 2	19 ¾	18 0	18 1¼	12 ¾	11 1¼	16 0	17 1	16 1¼	..	
10a	15 13	31 31	27 1½	25 3	19 1	32 21	26 ¾	28 ¾	21 ¾	9 ¾	31 1½	19 ¾	24 0½	29 0½	22 ¾	18 ¾	15 0½	12 ¾	23 0½	39 0½	24 1¾	8 0½	
10b		31 31	17 2½	25 2¼	25 0½	32 1¼	17 ¾	28 2¼	22 0½	15 2	39 0½	28 0½	27 2¼	34 2	27 3	25 2	18 2½	15 ¾	24 ¾	43 2¼	26 1¾	10 0½	

DIAGRAM 2.—Showing the effects of Ammonia-salts, and Mixed Mineral Manure, applied separately, in alternation, and in combination.

Plots.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	AVERAGE ANNUAL, 12 YEARS, 1852-63.		
													Produce.	Increase.	Description of Manure.
DRESSED CORN per Acre, in Bushels and Pecks.															
3	13 3¼	5 3¼	21 0¼	17 0	14 2	19 3¼	18 0	18 1¼	12 3½	11 1¼	16 0	17 1	15 2	..	Unmanured, every year (also for 8 preceding years).
5	16 3½	10 0½	24 0¾	18 1¼	19 2¼	23 3	19 0	20 2¼	15 3¼	15 1½	17 3¼	19 2¾	18 1¼	2 3¼	Mixed Mineral Manure alone, every year.
17	24 3¼	8 2¾	44 0¼	18 0¼	31 0	26 1¼	33 2¼	20 2	25 1	18 2¾	27 3	21 1	18 3¼	3 1¼	Mixed Mineral Manure alternated with Ammonia-salts (Plots 17 and 18).
18	14 1¼	19 1¼	23 3¼	33 0¾	17 3¼	40 2¼	21 3¼	32 2¼	15 3¼	32 3¼	18 2	46 1¼	32 2¼	17 0½	Ammonia-salts alternated with Mixed Mineral Manure (Plots 17 and 18).
10a	21 3½	9 3¼	34 1½	19 3¼	21 0¼	29 0½	22 3½	18 3¼	15 0½	12 3½	23 0¼	39 0½	22 2¼	7 0½	Ammonia-salts alone, every year (also for 7 preceding years).
10b	22 0¼	15 2	39 0¼	28 0½	27 2¼	31 2	27 3	25 2	18 2½	15 3¼	24 3¼	43 2¼	26 3¼	11 1¼	Ammonia-salts alone, every year (also in the preceding year).
7	26 3	23 2½	45 1¼	33 0	36 3¼	44 3¼	39 0¼	34 2¾	27 2¼	34 3¾	35 3½	53 2¼	36 1½	20 3¼	Ammonia-salts and Mixed Mineral Manure, every year.

Unmanured.

Ammonia-salts alone.

Mixed Mineral Manure alone.

Ammonia-salts and Mixed Mineral Manure.



In the 2nd year (1845), 10*a* and 10*b* were both manured with ammonia-salts at the rate of 336 lbs. per acre, and gave rather more than  $31\frac{3}{4}$  bushels of dressed corn, and rather more than 38 cwts. of straw, against scarcely  $23\frac{1}{4}$  bushels of dressed corn, and only  $24\frac{1}{4}$  cwts. of straw, on plot 3 without manure. Thus, whilst a mixed mineral manure gave scarcely any increase whatever in the first year, ammonia-salts alone gave an increase of rather more than  $8\frac{1}{2}$  bushels of dressed corn, and about  $13\frac{3}{4}$  cwts. of straw, in the second.

In the 3rd season (1845-6), 10*a* being again manured with ammonia-salts, gave nearly  $27\frac{1}{2}$  bushels of dressed corn, and 20 cwts. of straw, against not quite 18 bushels of dressed corn, and  $13\frac{1}{2}$  cwts. of straw, on the continuously unmanured plot (3). Ammonia-salts, again used alone, gave, therefore, an increase of nearly  $9\frac{1}{2}$  bushels of dressed corn, and about  $6\frac{1}{2}$  cwts. of straw. But plot 10*b* was left this year unmanured, and it gave about  $\frac{1}{4}$  bushel less dressed corn, and  $\frac{1}{2}$  cwt. less straw, than plot 3. Here, then, neither the unexhausted residue of the mineral manure supplied in 1844, nor that of the ammonia-salts supplied in 1845, gave any increase in 1846.

In the 4th year (1846-7), plots 10*a* and 10*b*, so differently treated in the preceding year, were again equally manured with ammonia-salts alone. The result was, almost identical amounts of both corn and straw in the two cases, and an increase over the unmanured plot of nearly 9 bushels of dressed corn, and about  $8\frac{3}{4}$  cwts. of straw.

In the 5th year (1847-8), the two plots again received equal amounts of ammonia-salts, but 10*b* had in addition a mineral manure supplying potass, soda, magnesia, lime, sulphuric acid, and phosphoric acid. Plot 10*b* was, therefore, in a more favourable condition than plot 10*a*, not only by virtue of this direct supply of mineral constituents, but also on account of the less exhaustion of them in 1846, when, being left unmanured, it gave so much less both of corn and straw than plot 10*a*. The result was, that, with  $14\frac{3}{4}$  bushels of dressed corn on the unmanured plot (3), 10*a*, with ammonia-salts alone for the 4th time, gave  $19\frac{1}{4}$ , and 10*b*, with ammonia-salts for the 3rd time, and with mineral manure in addition, rather over 25 bushels; and the amounts of straw were, on plot 3,  $15\frac{1}{4}$ , on plot 10*a* rather more than 21, and on plot 10*b* rather more than 26 cwts. There was, therefore, an increase of  $4\frac{1}{2}$  bushels of dressed corn, and  $5\frac{3}{4}$  cwts. of straw, on plot 10*a*; and of  $10\frac{1}{4}$  bushels of dressed corn, and  $10\frac{3}{4}$  cwts. of straw, on plot 10*b*; or a difference in favour of 10*b*, due to the greater abundance of mineral constituents, of nearly 6 bushels of dressed corn, and of 5 cwts. of straw. There was, then, already in the 4th year of the application of the ammonia-

salts alone, evidence of considerable relative deficiency of available mineral constituents, notwithstanding the application in the 1st year of silicate of potass and superphosphate of lime. Nor is this to be wondered at when it is considered that, in the 4 crops grown by ammonia-salts alone, there would probably be more than five times as much potass, about three times as much phosphoric acid, and more than thirty times as much silica removed from the land, as would be lost to it in a whole course of rotation of turnips, barley, clover, and wheat—supposing only the corn and meat to be sold, and the manure produced from the straw, and the consumption of the roots and clover, to be returned to the land.

In the 6th year (1848-9) both plots were again equally manured with ammonia-salts alone, and they gave almost identical quantities of dressed corn, amounting to about  $13\frac{1}{4}$  bushels more than that on the unmanured plot; whilst, of straw, 10*a* gave an increase of about 11 cwts., and the much less exhausted plot 10*b* only about 1 cwt. more.

In the 7th year (1849-50), 10*a* again received ammonia-salts alone, and gave nearly 27 bushels of dressed corn and  $27\frac{1}{2}$  cwts. of straw, which was equal to an increase over the unmanured produce of nearly 11 bushels of corn and about  $12\frac{1}{4}$  cwts. of straw. 10*b*, on the other hand, had a manure supplying liberally every mineral constituent at all likely to be wanting, except silica, but containing no ammonia, and the result was, an increase over the unmanured plot of little over 2 instead of 11 bushels of dressed corn, and of only about 2 instead of  $12\frac{1}{4}$  cwts. of straw. Thus, even in the 6th year of their application, ammonia-salts alone gave 9 bushels more dressed corn and nearly  $10\frac{1}{4}$  cwts. more straw, than the mixed mineral manure alone, notwithstanding that a relative deficiency of mineral constituents had shown itself 2 years previously, and that even on 10*b*, where so much less ammonia-salts had been applied in previous years, there had still been considerably more than twice as much nitrogen supplied as had been recovered as increased yield in the crop. The defective result on 10*b*, by the mineral manure alone, could not be due to the want of available silica, since the exhaustion of it was very much less than on 10*a*, which, nevertheless, gave so much more produce. It is, moreover, clear that, although the available supply of mineral constituents had become defective in relation to the amount of ammonia artificially supplied, it was still in excess relatively to the annually available supply of nitrogen from natural sources.

From this time forward, for 13 consecutive years, plots 10*a* and 10*b* received exactly the same amount of ammonia-salts annually (200 lbs. sulphate and 200 lbs. muriate), and neither of

them any mineral manure. During the first 2 years, the two plots, previously so differently manured, gave almost identical amounts of produce; but from that time forward, 10*b*, which, in the earlier years, had the ammonia-salts omitted twice, and twice received the mixed mineral manure when 10*a* had none, gave every year several bushels of corn (with its proportion of straw) more than 10*a*.

It is clear that 10*a* had become relatively very deficient in certain mineral constituents. Nor is this to be wondered at when the circumstances of the experiment are considered. To say nothing of silica and other constituents, the first 7 crops taken from 10*a* removed about  $1\frac{1}{2}$  time as much phosphoric acid, and more than twice as much potass, as were supplied in the first year (1843-4). On the other hand, 10*b* received in manure during the same 7 years, more than  $1\frac{1}{2}$  time as much phosphoric acid, and more than twice as much potass, as were removed in the crops. In other words, 10*a* was already much poorer, and 10*b* much richer, in both phosphoric acid and potass, than at the commencement.

If these circumstances are borne in mind the Summary Table XXIX., given overleaf, will have considerable interest.

During the 6 years, 1845-1850, plot 10*a* received 424 lbs. more sulphate and 200 lbs. more muriate of ammonia than plot 10*b*; but during the same period plot 10*b* received 600 lbs. pearl-ash, 400 lbs. soda-ash, 200 lbs. sulphate of magnesia, 400 lbs. bone-ash, and 300 lbs. sulphuric acid (sp. gr. 1.7), whilst plot 10*a* received no mineral manure. The result was, that whilst both plots gave a considerable increase, 10*a* gave a total of  $13\frac{1}{4}$  bushels of dressed corn, and 1278 lbs., or about  $11\frac{1}{2}$  cwts., of straw, more than 10*b*—equal to an average annual increase of  $2\frac{1}{4}$  bushels of dressed corn and nearly 2 cwts. of straw, due to the larger amount of ammonia-salts, notwithstanding the much more favourable condition of 10*b* as to mineral constituents.

Over the next 13 years, 1851-1863, during which neither plot received mineral manure, and both the same amount of ammonia-salts annually, 10*a*, previously so much more exhausted of mineral constituents, gave  $51\frac{1}{2}$  bushels of dressed corn, and 5483 lbs., or about 49 cwts., of straw less than 10*b*—equal to an average annual deficiency of nearly 4 bushels of dressed corn, and of  $3\frac{3}{4}$  cwts. of straw. It is worthy of remark, however, that although 10*b* continues to give notably more produce than 10*a*, due to the supply, and to the less exhaustion, of mineral constituents during the earlier years, it appears to be of late progressively declining in annual yield, and even somewhat more rapidly than 10*a*; for, if the average annual produce of the last 6 years be compared

TABLE XXIX.—PRODUCE OF WHEAT ON PLOT 10*a* compared with that on 10*b*, during the 6 Years, 1845—1850, the 13 Years, 1851—1863, and the whole 19 Years, 1845—1863.Plot 10*a*. Ammonia-salts every Year.Plot 10*b*. Without Manure the 2nd Year, with Mineral Manure the 4th and 6th Years, and Ammonia-salts the 1st, 3rd, 4th, 5th, 7th, and succeeding Years.

Plots.	6 Years, 1845—1850.		13 Years, 1851—1863.		19 Years, 1845—1863.	
	Total.	Average Annual.	Total.	Average Annual.	Total.	Average Annual.

## Dressed Corn, per Acre; in Bushels and Pecks.

10 <i>a</i>	163 2 $\frac{3}{4}$	27 1 $\frac{1}{4}$	300 1 $\frac{1}{4}$	23 0 $\frac{1}{2}$	464 0	24 1 $\frac{3}{4}$
10 <i>b</i>	150 1 $\frac{1}{4}$	25 0 $\frac{1}{4}$	351 3 $\frac{1}{2}$	27 0 $\frac{1}{2}$	502 1 $\frac{1}{4}$	26 1 $\frac{3}{4}$
10 <i>a</i> over or under 10 <i>b</i>	+13 1	+2 1	-51 2 $\frac{1}{4}$	-4 0	-38 1 $\frac{1}{4}$	-2 0

## Weight per Bushel of Dressed Corn; lbs.

10 <i>a</i>	..	60·3	..	56·3	..	57·6
10 <i>b</i>	..	60·6	..	57·4	..	58·4
10 <i>a</i> over or under 10 <i>b</i>	..	-0·3	..	-1·1	..	-0·8

## Total Corn, per Acre; lbs.

10 <i>a</i>	10,728	1788	19,194	1476	29,922	1575
10 <i>b</i>	9,833	1639	22,254	1712	32,087	1689
10 <i>a</i> over or under 10 <i>b</i>	+895	+149	-3,060	-236	-2165	-114

## Total Straw (and Chaff), per Acre; lbs.

10 <i>a</i>	17,708	2951	34,302	2639	52,010	2737
10 <i>b</i>	16,430	2738	39,785	3060	56,215	2958
10 <i>a</i> over or under 10 <i>b</i>	+1,278	+213	-5,483	-421	-4,205	-221

## Total Produce (Corn and Straw), per Acre; lbs.

10 <i>a</i>	28,436	4739	53,496	4115	81,932	4312
10 <i>b</i>	26,263	4377	62,039	4772	88,302	4647
10 <i>a</i> over or under 10 <i>b</i>	+2,173	+362	-8,543	-657	-6,370	-335



with that of the preceding 6, it is found that, whilst 10*a* has given  $1\frac{1}{4}$  bushel of dressed corn and 180 lbs. of straw, 10*b* has given  $1\frac{3}{4}$  bushel of dressed corn and 304 lbs. of straw, less over the later than over the earlier period.

Over the whole 19 years, plot 10*a*, with its larger amount of ammonia-salts and less supply of mineral constituents, gave  $38\frac{1}{4}$  bushels of dressed corn, and 4205 lbs., or about  $37\frac{1}{2}$  cwts., of straw less than 10*b*—equal to an average annual deficiency of 2 bushels of dressed corn, and nearly 2 cwts. of straw.

Here, then, is an obvious case of exhaustion of available mineral constituents relatively to the available supply of nitrogen, and also a very marked effect from the unexhausted residue of the mineral manures applied in the earlier years.

It would be inappropriate to go into detail as to the comparative exhaustion of the two plots in respect to individual mineral constituents without adducing the results of analysis relating to the subject. But it may be stated generally, that the average percentage of mineral matter is considerably lower in the produce of plot 10*a*, than in that of plot 3 without manure; and further, that in the ash of the grain the proportion of phosphoric acid, and in that of the straw the proportion of the silica more particularly, is becoming reduced. During these 19 years, however, there have been removed from the plot as much phosphoric acid as would suffice for more than 50 years, as much potass as would suffice for more than 100 years, and as much silica as would suffice for more than 500 years of ordinary rotation, where only corn and meat are sold, and the due proportion of the home-manures are periodically returned to the land; whilst the first five crops of the twenty would remove about as much phosphoric acid, and the first three about as much potass, as was supplied in the first year of the experiments.\* Under such very unusual treatment, it is certainly not surprising that the annually available mineral constituents of the soil should prove to be insufficient.

Diagram II. (facing p. 461), further illustrates the point in question. There are there shown, side by side, the bushels of dressed corn per acre, in each of the last 12 years of the experiments, on plots 3, 5, 17, 18, 10*a*, 10*b*, and 7; and the further

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\* Baron Liebig tells his readers that we applied in the first year as much soluble phosphoric acid as would be contained in about 1750 lbs. of guano. The fact is, that the total phosphoric acid applied would be contained in about one-half that amount of Peruvian guano of average composition. He also misrepresents our conclusions; and so, as in other instances, by the aid of his own misstatements, makes a point for ridicule where he cannot controvert. (*Einleitung* and '*Natural Laws of Husbandry*,' p. 300, and context.)

conditions and results of the different experiments will be sufficiently understood from the following few comments.

It is seen, as shown in another form in Table XXVI., that plots 5, and 17 or 18, give almost identical amounts of average annual produce, and therefore of average annual increase over plot 3, during the 12 years in question—the one (plot 5) having mixed mineral manure alone every year, but succeeding heavy dressings of mineral manure and ammonia-salts in preceding years, and the others having the same mixed mineral manure each year succeeding an excess of ammonia-salts in the preceding year, and succeeding also, as on plot 5, mixed mineral manure and ammonia-salts in the earlier years.

But the point which it is the chief object of Diagram II. to illustrate is, the very different effect of a given amount of ammonia-salts according to the supply of available mineral constituents within the soil.

During each of the 12 years, plots 10*a*, 10*b*, 17 or 18, and 7, each received exactly the same amount of ammonia-salts; and, taking the results of each year separately, the order as to amount of produce is, invariably—plot 7 (highest), 17 or 18, 10*b*, and 10*a* (lowest); that is, the lowest where the mineral constituents were the most exhausted, and the highest where their supply was most liberal.

The point is also well illustrated by reference to the average annual results over the 12 years. Thus, the average annual increase (over the unmanured produce) was:—on 10*a*, with ammonia-salts alone (not only each year of the 12, but for seven years previously),  $7\frac{1}{8}$  bushels of dressed corn, and nearly  $8\frac{1}{2}$  cwt. of straw; on 10*b*, also with ammonia-salts alone every year of the 12, and for some years previously, but with mineral manure in two of the seven preceding years, nearly  $11\frac{1}{2}$  bushels of dressed corn, and  $12\frac{1}{2}$  cwt. of straw; on 17 or 18, where ammonia-salts each year succeeded mineral manure,  $17\frac{1}{8}$  bushels of dressed corn, and nearly  $18\frac{3}{4}$  cwt. of straw; and, lastly, on plot 7, with the ammonia-salts and mixed mineral manure used each year together, nearly 21 bushels of dressed corn, and  $22\frac{3}{4}$  cwt. of straw.

With the same amounts of ammonia-salts, therefore, there was a difference in the amount of increase of produce annually obtained of from  $7\frac{1}{8}$  bushels of dressed corn and nearly  $8\frac{1}{2}$  cwt. of straw, to  $20\frac{7}{8}$  bushels of corn and  $22\frac{3}{4}$  cwt. of straw, according to the supply of available mineral constituents within the soil. There was a difference of from  $7\frac{1}{8}$  bushels of corn and nearly  $8\frac{1}{2}$  cwt. of straw, to nearly  $11\frac{1}{2}$  bushels of corn and  $12\frac{1}{2}$  cwt. of straw, due to the application of mineral manure twice in the earlier years of the experiments (10*b*); and there was a difference

of from  $17\frac{1}{2}$  bushels of dressed corn and nearly  $18\frac{3}{4}$  cwts. of straw, to  $20\frac{7}{8}$  bushels of corn and  $22\frac{3}{4}$  cwts. of straw, due to the application of the mixed mineral manure each year in conjunction with the ammonia-salts, instead of each year preceding them as on plots 17 or 18.

In the greater amount of increase on 10*b* than on 10*a*, there is striking evidence of the permanent and lasting effect of the unexhausted residue of the artificially applied mineral constituents, if only available nitrogen be provided within the soil. On the other hand, the greater amount of increase on plot 7 than on plots 17 or 18, shows the much greater effect of the mineral constituents when applied at the same time with the ammonia-salts. Nevertheless, there is no doubt that even plots 17 and 18 received much more of all those mineral constituents that were supplied than was removed of them in the crops. The condition and distribution of the constituents within the soil, would, however, be very different in the two cases.

The very interesting and important results which have been briefly passed in review in this Section, especially those to which the coloured Diagrams refer, may be still more briefly summarised as follows:—

1. A somewhat heavy loam, of fair average wheat-producing quality, taken at the end of a five-course rotation since manuring, gave scarcely any increased produce of wheat in the year of the application when manured with a mixture of silicate of potass and superphosphate of lime; but it gave a very considerable, though progressively diminishing, amount of increase, when afterwards manured for 19 consecutive years with ammonia-salts alone.

2. It is obvious that, taken in the condition of practical exhaustion specified, the soil still contained an excess of annually available mineral constituents, relatively to the annually available nitrogen supplied by soil and season without manure. When, however, large quantities of ammonia-salts were annually applied, the relative deficiency of mineral constituents became apparent, even as early as the fourth year of their application.

3. When ammonia-salts were applied, the greater portion of the nitrogen remained unrecovered as increased yield in the crop for which it was employed.

4. The unexhausted residue of nitrogen supplied as manure, was but very partially and very slowly recovered as increased yield in succeeding years, even when followed by the liberal application of such mineral manure as was very effective when used in conjunction with newly applied ammonia-salts.

5. Mineral constituents supplied in the soluble form in the 5th and 7th years of the experiments (though giving very little

increase when in the latter year they were used alone), continued to increase the effect of ammonia-salts afterwards annually applied for 13 consecutive years.

6. A given amount of ammonia-salts gave very different amounts of increase, according to the supply of available mineral constituents within the soil; giving very much more when mineral manures were applied in the same, than in the preceding year, notwithstanding that, in the latter case, there could be no deficiency, though doubtless less favourable condition and distribution of the mineral constituents.

7. The same mineral manures which were very effective when supplied with ammonia-salts, gave very little increase of produce when used alone year after year for 12 years, although following an excess of ammonia-salts applied in preceding years; and they gave very little more when they were applied every year succeeding an excess of ammonia-salts applied in the immediately preceding year.

8. The unexhausted residue from previous mineral manuring, though it served as an effective reserve against exhaustion, had little or no effect in increasing the growth of wheat without the aid of available nitrogen provided within the soil. An unexhausted residue from previous nitrogenous manuring had also but little influence upon the immediately succeeding crops, even when aided by the application of mineral manures.

The bearing of the facts adduced in this Section, upon the question of the probable influence on the mineral wealth of our soils, of the use of artificial nitrogenous manures, under the circumstances, and in the degree, in which they are generally employed in the ordinary course of agriculture in this country, will be considered further on, when the whole of the experimental evidence which it is proposed to bring forward in the present Report is before the reader.

With regard to the bearing of the results on the subject of the next Section, it is obvious that the degree and limit of effect of the unexhausted residue of previous manuring, whether nitrogenous or mineral, are such that, if the circumstances of the different plots are duly considered, there will be little danger of misinterpreting the results obtained on the application of the different manures year after year on the same plot during the last 12 years.

### III. AVERAGE ANNUAL RESULTS OVER THE LAST 12 YEARS.

Subject to such reservations as the facts already adduced suggest, and to others which will be referred to in the course of the discussion, attention may now be directed to the average annual



results over the last 12 years, from each description of manure applied year after year on the same plot, during the whole of that period. These are given in Table XXX., pp. 470, and 471. The details of the manures are given in Appendix Table IX., and are further explained in the Notes at p. 163, facing that Table. The details of the produce of each separate plot in each separate year will be found in Appendix Tables X.—XXVI., pp. 164-185.

It may be explained that in the Summary Table XXX., wherever the plots are divided into two (*a* and *b*), and both portions are manured alike, giving duplicate experiments and results, the mean of the two only is given.

*Average Annual Produce without Manure.*

There were three plots entirely unmanured during the last 12 years of the experiments to which the results in Table XXX. refer. Plot 3, had been unmanured for the 8 preceding years also, as well as during the 5 years of rotation before the experiments commenced. Plot 20, which was at the other side of the field, had been unmanured the same number of years as plot 3, with the exception that in the third year it received a mixture of the surplus of the artificial manures used on the other plots. Plot 4 had been unmanured during the last 12 years only; during the preceding 7 years it had been manured with large quantities of superphosphate of lime and sulphate of ammonia, and in the first year of the 20 was manured with the ashes of farmyard manure.

Plot 3, which had grown wheat without manure for the whole 20 years, and plot 20 for 19 out of the 20, gave almost identical average annual amounts of produce over the last 12 years. On almost every point, however, plot 20 gave slightly the better result; but the difference is so small that the experiments mutually confirm each other, and the produce of plot 3 (continuously unmanured) is adopted as the standard by which to compare that of the manured plots.

Its average annual yield per acre over the 12 years was 15½ bushels of dressed corn, and 1662 lbs. or nearly 15 cwts. of straw. The average weight per bushel of the dressed corn was lower than in any case but two of the manured produce; but the proportion of corn to straw was almost exactly the same as with farmyard manure, and higher than in most cases with artificial manure.

The tendency to produce a fair proportion of corn to straw was, therefore, without manure, more than equal to that under the majority of the conditions with manure; and the low weight per bushel was, doubtless, due to the sluggish growth and consequent defective power of ripening.

Plot 4,

EXPERIMENTS AT ROTHAMSTED ON THE GROWTH OF  
TABLE XXX.—AVERAGE PRODUCE, and INCREASE by MANURE,

Plots.	Manures per Acre, per Annum, for 12 Years; 1852-1863. (For further particulars see Appendix Table IX. and Notes, pp. 162-3; and for the Manures previous to 1852 see Appendix Tables I.-VIII. pp. 146-161).	PRODUCE, &c.			
		Dressed Corn.		Total Corn.	
		Quantity.	Weight per Bushel.		
		bush.	pks.	lbs.	lbs.
2	14 Tons Farmyard Manure, every year (20 years, 1844-63)	35	1½	59·3	2232
3	Unmanured (20 years, 1844-63) .. .. .	15	2	56·5	964
20	Unmanured (17 years, 1847-63) .. .. .	15	2½	57·0	989
4	Unmanured (12 years, previously Superphosphate of Lime and Ammonia-salts) .. .. .	16	3¾	57·2	1072
0	Superphosphate of Lime <sup>1</sup> (16 years, 1848-63) .. .. .	18	1	57·5	1143
1	Sulphates of Potass, Soda, and Magnesia (15 years, 1849-63)	16	1½	57·2	1025
5 (a & b)	Mixed Mineral Manure <sup>2</sup> .. .. .	18	1¾	57·9	1157
21	100 lbs. Muriate Ammonia, and Mixed Mineral Manure ..	22	0¾	57·9	1384
22	100 lbs. Sulphate Ammonia, and Mixed Mineral Manure ..	21	2¾	57·8	1362
6 (a & b)	200 lbs. Ammonia-salts <sup>3</sup> , and Mixed Mineral Manure ..	28	1¼	58·6	1371
7 (a & b)	400 lbs. Ammonia-salts, and Mixed Mineral Manure ..	36	1½	58·4	2275
8 (a & b)	600 lbs. Ammonia-salts, and Mixed Mineral Manure ..	38	0	57·8	2382
16 (a & b)	800 lbs. Ammonia-salts, and Mixed Mineral Manure ..	38	2	57·6	2425
17 (a & b) or 18 (a & b)	Mixed Mineral Manure (in alternation with 400 lbs. Ammonia-salts) .. .. .	18	3½	58·0	1187
	400 lbs. Ammonia-salts (in alternation with Mixed Mineral Manure) .. .. .	32	2½	58·7	2054
10 (a)	400 lbs. Ammonia-salts, alone (19 years Ammonia-salts alone, 1845-63) .. .. .	22	2½	55·9	1438
10 (b)	400 lbs. Ammonia-salts, alone (13 years, 1851-63) .. ..	26	3¾	57·0	1698
11 (a & b)	400 lbs. Ammonia-salts, and Superphosphate of Lime ..	29	2½	56·5	1858
12 (a & b)	400 lbs. Ammonia-salts, Superphosphate of Lime, and Sulphate of Soda .. .. .	35	0¾	58·3	2200
13 (a & b)	400 lbs. Ammonia-salts, Superphosphate of Lime, and Sulphate of Potass .. .. .	34	2¼	58·6	2188
14 (a & b)	400 lbs. Ammonia-salts, Superphosphate of Lime, and Sulphate of Magnesia .. .. .	35	0	58·3	2198
9 (a)	550 lbs. Nitrate of Soda, and Mixed Mineral Manure <sup>4</sup> ..	34	2	57·1	2168
9 (b)	550 lbs. Nitrate of Soda, alone <sup>5</sup> .. .. .	25	3¼	55·4	1628
15 (a)	400 lbs. Ammonia-salts, Mixed Alkalies <sup>6</sup> , and Superphosphate of Lime <sup>7</sup> .. .. .	33	0¾	58·6	2088
15 (b)	300 lbs. Ammonia-salts, Mixed Alkalies, <sup>6</sup> Superphosphate of Lime, <sup>7</sup> and 500 lbs. Rape-Cake .. .. .	34	3½	58·7	2188
19	300 lbs. Ammonia-salts, Superphosphate of Lime, <sup>7</sup> and 500 lbs. Rape-cake .. .. .	31	2¾	58·1	2018

<sup>1</sup> "Superphosphate of Lime"—4 parts Bone-ash, and 3 parts Sulphuric Acid, Sp. gr. 1·7.  
<sup>2</sup> "Mixed Mineral Manure"—Superphosphate of Lime, and Sulphates of Potass, Soda, and Magnesia.  
<sup>3</sup> "Ammonia-salts"—equal parts Sulphate and Muriate of Ammonia of Commerce.  
<sup>4</sup> 9a—the Mixed Mineral Manure not applied until the 12th Season, 1854-5; and only 475 lbs. Nitra

## WHEAT YEAR AFTER YEAR ON THE SAME LAND.

per Acre, per Annum, over 12 Years, 1852-63.

PRODUCE, &c.			INCREASE.								Plots.		
Straw (and chaff).	Total Produce (Corn and Straw).	Corn to 100 Straw.	Dressed Corn.		Total Corn.		Straw and Chaff.		Total Produce.				
			Over Un- manured (Plot 3).	Over Mixed Mineral Manure (Plots 5a & b).	Over Un- manured (Plot 3).	Over Mixed Mineral Manure (Plots 5a & b).	Over Un- manured (Plot 3).	Over Mixed Mineral Manure (Plots 5a & b).	Over Un- manured (Plot 3).	Over Mixed Mineral Manure (Plots 5a & b).			
lbs.	lbs.		bush.	pkts.	bush.	pkts.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
869	6101	57.9	19	3½	..	..	1268	..	2207	..	3475	..	2
662	2626	57.8	..	..	..	..	..	..	..	..	..	..	3
714	2703	57.9	0	0½	..	..	25	..	52	..	77	..	20
732	2804	61.6	1	1¾	..	..	108	..	70	..	178	..	4
846	2989	61.9	2	3	..	..	179	..	184	..	363	..	0
767	2792	58.0	0	3½	..	..	61	..	105	..	166	..	1
897	3054	62.0	2	3¾	..	..	193	..	235	..	428	..	5 (a & b)
343	3727	59.7	6	2¾	3	3	420	227	681	446	1101	673	21
308	3670	59.0	6	0¾	3	1	398	205	646	411	1044	616	22
012	4783	59.0	12	3½	9	3½	807	614	1350	1115	2157	1729	6 (a & b)
212	6487	54.1	20	3½	17	3¾	1311	1118	2550	2315	3861	3433	7 (a & b)
715	7097	50.4	22	2	19	2¼	1418	1225	3053	2818	4471	4043	8 (a & b)
152	7577	47.3	23	0	20	0½	1461	1268	3490	3255	4951	4523	16 (a & b)
092	3179	59.7	3	1½	0	1¾	223	30	330	95	553	125	17 (a & b)
155	5809	55.0	17	0½	14	0¾	1090	897	2093	1858	3183	2755	18 (a & b)
303	4038	54.0	7	0½	4	0¾	471	278	941	706	1412	984	10 (a)
061	4754	54.6	11	1¾	8	2	729	536	1399	1164	2128	1700	10 (b)
33	5092	57.1	14	0½	11	0¾	895	702	1571	1336	2466	2038	11 (a & b)
47	6147	55.7	19	2¾	16	3	1236	1043	2285	2050	3521	3093	12 (a & b)
89	6173	54.9	19	0¼	16	0½	1220	1027	2327	2092	3547	3119	13 (a & b)
01	6199	54.9	19	2	16	2¼	1234	1041	2339	2104	3573	3145	14 (a & b)
26	6587	48.5	19	0	16	0½	1197	1004	2764	2529	3961	3533	9 (a)
87	4808	49.8	10	1¼	7	1½	657	464	1525	1290	2182	1754	9 (b)
95	5883	54.9	17	2¾	14	3	1124	931	2133	1898	3257	2829	15 (a)
28	6214	54.4	19	1½	16	1¾	1222	1029	2366	2131	3588	3160	15 (b)
21	5537	57.2	16	0¾	13	1	1052	859	1859	1624	2911	2483	19

Soda for the 9th, and 275 lbs. for the 10th, and 11th Seasons.

9b—in the 9th Season only 475 lbs. of Nitrate of Soda.

"Mixed Alkalies"—Sulphates of Potass, Soda, and Magnesia.

For Plots 15a, 15b, and 19, the Bone-ash decomposed by Muriatic Acid of Commerce, instead of Sulphuric Acid.

Plot 4, unmanured for the 12 years only, and manured for 7 years previously with superphosphate of lime and ammonia-salts, and for 1 year with the ashes of farmyard dung (supplying very much more phosphoric acid than was removed in the crops, and considerably more of nitrogen and of every mineral constituent than was removed in the increase of the crops), gave an annual average during the subsequent 12 years of nearly  $11\frac{1}{2}$  bushel of dressed corn, and a little straw also, more than either plot 3 or plot 20. Bearing this difference in mind, we shall see that the result accords very well with that of the other unmanured plots; and, as shown more in detail in Section II., usefully indicates the limit of effect on immediately succeeding crops of an unexhausted residue from previous manuring. It is worthy of remark, however, that the produce of this plot had nearly as high a proportion of corn to straw as that of any in the entire series; being only surpassed on this point by that of plots 0 and 5, on which, as on plot 4, phosphoric acid would be present in large proportion relatively to other constituents, when compared with the condition of other plots in this respect.

An average annual produce of wheat, amounting to from 15 to 16 bushels of corn, and from 15 to 16 cwt. of straw, without manure of any kind, is looked upon by many as an extraordinary yield, and as indicating a somewhat unusual quality of land. There is no doubt that it bears a higher proportion than might be expected, to the produce obtained, even under rotation with periodical manuring, in a large majority of cases where land is badly farmed, and deficient range and aeration of soil, luxuriant weeds, and defective manuring, have all their share in the miserable result. The experimental land, though kept extremely clean, was not, however, ploughed more deeply than in the ordinary practice of the farm; and, there can be little doubt, that a large proportion of those soils of the country which are recognised as possessing average wheat-producing qualities, would yield very similar results, if kept equally clean and otherwise as well cultivated; whilst some would, under like conditions, produce much more, though, many light soils probably much less.

#### *Average Annual Produce by Farmyard Manure.*

The average annual produce by farmyard manure over the last 12 years was  $35\frac{3}{4}$  bushels of dressed corn, and 3869 lbs. or about  $34\frac{1}{2}$  cwt. of straw; equal to an average annual increase over the produce of plot 3 of nearly 20 bushels of corn, and nearly 20 cwt. or 1 ton of straw.

As has been already pointed out (see Table XXIII. and comments thereon), whilst the average annual produce without manure was nearly the same during the earlier and the later



years, that by farmyard manure was very much greater over the last 10 than the first 10 years of the experiments; though it increased in a considerably less degree during the last 6 as compared with the preceding 6 years.

The total produce during the 20 years was, without manure, 324 $\frac{3}{8}$ , and with farmyard manure 648 $\frac{7}{8}$  bushels of dressed corn; and without manure 302 $\frac{1}{4}$ , and with farmyard manure 627 $\frac{3}{4}$  cwt. of straw; or almost exactly double the amount of corn, and more than double the amount of straw, with the farmyard manure. It further gave nearly double as much average annual increase of corn, and more than 1 $\frac{1}{2}$  times as much increase of straw, over the second as over the first 10 years; and whilst the weight per bushel of the dressed corn was, without manure lower during the later than during the earlier half of the period, with the farmyard manure it was higher during the later period.

During the whole 20 years 280 tons of farmyard manure were applied per acre, and there have been yielded about 18 $\frac{1}{2}$  tons of corn and nearly 31 $\frac{1}{2}$  tons of straw, equal to nearly 50 tons of total produce. The manure applied would not only convey to the land more of every constituent than was contained in the increase of crop, but nearly twice as much dry organic matter, and much more than twice as much of nitrogen, phosphoric acid, and potass (and probably every other mineral constituent), as was contained in the total produce removed from the land. There has, therefore, been a great accumulation of constituents by the soil. No wonder, then, that the plot should yield such a much higher average annual produce during the later than during the earlier years. On the other hand, several of the artificial manures gave a considerably higher average produce than the farmyard manure; and whilst several gave more than 50 bushels in the twentieth season, 1863, without any artificial supply of either available silica or carbonaceous organic matter during the whole period of the experiments, the farmyard manure gave only 44 bushels, and also less straw. It gave, however, the highest weight per bushel in the series.

A consideration of the results obtained by the other manures will indicate to which of the constituents of the farmyard manure its effects were mainly due, and which were superfluous, if not even in some way instrumental in limiting the productive activity of the constituents associated with them.

*Average Annual Produce by Mineral Manure alone.*

Plots 0, 1, and 5 had each mineral manure alone during the last 12 years.

Plot 0 was manured with a large quantity of superphosphate

of lime alone in each of the 12, and in the 4 preceding years, and previously with Peruvian guano or the mixture of the surplus of the other manures. Under these conditions the average annual produce during the last 12 years was  $18\frac{1}{4}$  bushels of dressed corn, and 1846 lbs., equal about  $16\frac{1}{2}$  cwt. of straw; equivalent to an average annual increase over the unmanured plot of only  $2\frac{3}{4}$  bushels of corn, and 184 lbs. of straw, and to a deficiency compared with the produce by farmyard manure of about 17 bushels of corn, and 18 cwt. of straw. Since a portion of the small increase was, doubtless, due to the unexhausted residue of previous nitrogenous manuring, it is obvious that but little remains to be attributed to the subsequent annual supply of superphosphate of lime. It is obvious, too, that if it were in mineral constituents that the soil had become relatively deficient by the previous cropping, it was not for want of phosphoric acid alone that the plot yielded so little more produce than was obtained without manure, and so much less than was obtained with farmyard manure.

Nor was it in potass, soda, magnesia, and sulphuric acid alone, that the soil had become relatively exhausted; for on plot 1 these constituents were supplied liberally every year for 15 consecutive years, and the average annual produce and increase over the 12 years were even less than on plot 0 with superphosphate of lime. The increase over the unmanured produce was, in fact, not quite 1 bushel of dressed corn, and not quite 1 cwt. of straw, per acre per annum.

Plot 5, was manured with a mixture of both superphosphate of lime, and the sulphates of potass, soda, and magnesia, supplying to the soil much more of probably every mineral constituent, except silica, than was taken off in the crops. But this mixture gave scarcely any more increase than the superphosphate of lime alone, and part of that which it did give has been shown to be most probably due to the unexhausted residue of previous nitrogenous manuring.

It was not, therefore, for want of mineral constituents, unless of available silica, that the soil had become, by the previous cropping, incapable of producing full wheat crops. The defective result, as compared with that by farmyard manure, was obviously due to the want of some constituent which was supplied by it, but not in either of the artificial mineral manures. The questions arise—was the wanting constituent available silica?—was it organic matter yielding carbon to the plant?—or was it nitrogen in some available form of combination? These questions will be pretty satisfactorily answered by the results considered in the next Section.

*Average Annual Produce by Mineral Manure and Ammonia-Salts.*

The plots included in this series are Nos. 21, 22, 6, 7, 8, and 16, to each of which exactly the same mixed mineral manure (consisting of superphosphate of lime and the sulphates of potass, soda, and magnesia) was applied as that which was used alone on plot 5, and then gave less than  $18\frac{1}{2}$  bushels produce, and less than 3 bushels' increase of dressed corn; but it was now employed in conjunction with ammonia-salts, in amounts varying from 100 lbs. to 800 lbs. per acre per annum.

On plot 21 the mixed mineral manure was used with 100 lbs. of the muriate, and on plot 22 with 100 lbs. of the sulphate of ammonia of commerce. The muriate contained rather more ammonia than the sulphate, and gave rather more than 22 bushels, whilst the latter gave rather less, and also rather less straw. The increase over the produce by the mixed mineral manure alone, was  $3\frac{3}{4}$  bushels of corn and 4 cwts. of straw with the muriate, and  $3\frac{1}{4}$  bushels of corn and rather less than  $3\frac{3}{4}$  cwts. of straw with the sulphate. In each case, therefore, the addition of 100 lbs. of ammonia-salt to the mixed mineral manure, gave more increase over the produce by the mineral manure alone, than was obtained over the unmanured produce by the use of the mineral manure itself, though it supplied annually an abundance of potass, soda, magnesia, lime, phosphoric acid, and sulphuric acid.

Yet the proportion of increase obtained for a given amount of ammonia in these two experiments was less than is usual when such moderate quantities are used. Indeed, the results which follow will show that it was considerably less than when twice, and even four times as much ammonia was employed with the same mineral manure. The fact is, plots 21 and 22 were comparatively short lengths of land, so near to the hedge-green as to be to some extent affected by trees (especially 21), and they were only brought under exact experiment in the ninth and succeeding years as being the most eligible of the remaining unallotted portions of the experimental field. Their results are, therefore, not so trustworthy as those obtained on the other and larger areas.

On plots 6, 200 lbs. of ammonia-salts (equal parts sulphate and muriate) were used with the mineral manure, and the mixture gave an average annual produce of  $28\frac{1}{4}$  bushels of dressed corn, and 3012 lbs. = nearly 27 cwts. of straw, or an increase over the produce by the mixed mineral manure alone of  $9\frac{7}{8}$  bushels of corn, and 1115 lbs. = nearly 10 cwts. of straw, which is much more for a given amount of ammonia than was obtained on plots 21 and 22, where the smaller amounts of ammonia-salts were employed.

On plots 7, the amount of ammonia-salts was again doubled, 400 lbs. being now used. The average annual produce amounted to 36 $\frac{3}{8}$  bushels of dressed corn, and to 4212 lbs. = about 37 $\frac{1}{2}$  cwt. of straw; and the increase over the produce with the mixed mineral manure alone was very nearly 18 bushels of dressed corn, and 2315 lbs. = about 20 $\frac{1}{2}$  cwt. of straw.

The proportion of increase for a given amount of ammonia-salts was in corn not quite so great, but in straw rather more, when 400 than when only 200 lbs. of ammonia-salts were used. But 400 lbs. is a very heavy dressing; and although it may, under favourable circumstances, give proportionally as much increase as a smaller amount, it is doubtless more than in the case of the soil in question, or indeed of most soils, is calculated to give on the average of seasons, a maximum result for a given amount of ammonia employed.

Still, even with 600 lbs. of ammonia-salts (plots 8) there was a further increment, and with 800 lbs. (plots 16) still a further increment of increase; though at a much diminishing rate for a given amount of ammonia the greater the quantity employed, and the diminution was the greater in the corn than in the straw.

Thus, by the addition to the mixed mineral manure of 200 lbs. of ammonia-salts there were obtained 9 $\frac{7}{8}$ , by 400 lbs. nearly 18, by 600 lbs. little more than 19 $\frac{1}{2}$ , and by 800 lbs. little more than 20 bushels increase of corn; and of increase of straw there was obtained by 200 lbs. of ammonia-salts 1115 lbs., by 400 lbs. 2315 lbs., by 600 lbs. 2818 lbs., and by 800 lbs. 3255 lbs. Exhibited from a more striking point of view, the result is, that each successive increment of 200 lbs. of ammonia-salts gave increased produce as under:—

	Corn.		Straw.	
	Bush.	plks.	lbs.	
1st increment (200 lbs. applied) gave	9	3 $\frac{1}{2}$	and	1115
2nd increment (400 lbs. applied) „	8	0 $\frac{1}{4}$	„	1200 more than 200 lbs.
3rd increment (600 lbs. applied) „	1	2 $\frac{1}{2}$	„	503 „ 400 lbs.
4th increment (800 lbs. applied) „	0	2	„	437 „ 600 lbs.

It is seen that any additional produce yielded by the use of more than 400 lbs. of ammonia-salts per acre, was obtained at the cost of very much more ammonia for a given amount of increase. Moreover, as an inspection of Table XXX. will show, the weight per bushel of dressed corn was less, and the proportion of corn to 100 of straw very much less, under the influence of the excessive amounts of ammonia-salts.

Before leaving this series of experiments, attention should be called to the fact, that where 400 lbs., and upwards, of ammonia-salts were used in conjunction with the mixed mineral manure, the produce, both corn and straw, exceeded that by farmyard



manure, with all its supply of silica, and organic matter yielding carbon, both of which were entirely absent in the artificial manures. To this point further reference will be made.

*Average Annual Produce by 400 lbs. of Ammonia-Salts per Acre, alone, in alternation with the Mixed Mineral Manure, and in combination with different descriptions of Mineral Manure.*

Throughout the preceding series the same mixed mineral manure was always used, but in conjunction with varying amounts of ammonia-salts. In the series now to be considered, a fixed quantity of ammonia-salts (400 lbs. per acre per annum) was employed throughout, but under varying conditions as to the supply of mineral constituents.

The results of this series which stand first in order in the Table, those of plots 17 and 18, where the ammonia-salts were used in alternation with the mixed mineral manure, have been so fully discussed in Section II. (pp. 457-8 and 466-7) that it is only necessary here to recall attention to the fact, that under these conditions the 400 lbs. of ammonia-salts gave an average annual increase of scarcely  $14\frac{1}{4}$  bushels of dressed corn, and only 1858 lbs. =  $16\frac{1}{2}$  cwts. of straw, more than the mineral manure alone; whilst the same amount of ammonia-salts, used in conjunction with the mineral manure, as on plots 7, gave an increase of nearly 18 bushels of dressed corn, and 2315 lbs. =  $20\frac{3}{4}$  cwts. of straw.

It has also already been shown how much less was the effect of 400 lbs. of ammonia-salts when used for 19 years without mineral manure, as on plot 10a, or for 13 years only, as on plot 10b, than when they were used in conjunction, or even in immediate alternation, with the mixed mineral manure.

The results next in order, those of plots 11, 12, 13, and 14, show in an interesting manner the more or less diminished effect when the mineral manure was less complete than the so-called "mixed mineral manure" employed on plots 17, 18 and 7, and occasionally on plot 10b.

During the first 8 years of the 20, that is, during the 8 immediately preceding the 12 the average produce of which is now under consideration, plots 11, 12, 13, and 14, all received in manure from  $2\frac{1}{2}$  to 3 times as much phosphoric acid as was taken off in the crops, and all much about the same excess. Of potass, all four plots yielded much about the same amount in their produce; but whilst plot 11 received no direct supply in manure (only a small quantity in rape cake), plots 12, 13, and 14, each received from two to three times as much as was removed from them; the accumulation being somewhat the greatest on plot 13.

During the last 12 years, in addition to the 400 lbs. of ammonia-salts per acre per annum, plots 11 have had superphosphate

of lime, plots 12 superphosphate of lime and sulphate of soda, plots 13 superphosphate of lime and sulphate of potass, and plots 14 superphosphate of lime and sulphate of magnesia. The object of this arrangement was to trace, by the exclusion of certain constituents, the point at which they, respectively, became deficient.

Up to the present time there is scarcely an appreciable difference in the amounts of produce on plots 12 with soda to the exclusion of potass and magnesia, on plots 13 with potass to the exclusion of soda and magnesia, and on plots 14 with magnesia to the exclusion of potass and soda. It is obvious, therefore, that either the available natural, or the previous artificial, supplies of the respective bases within the soil, have so far prevented relative deficiency of either.

When, however, the produce of these three plots is compared with that of plots 7, manured each year with the same amounts of ammonia-salts and superphosphate of lime, and, in addition, a mixture of the sulphates of potass, soda, and magnesia, instead of only one of them, it is found that they give annually from 1 to 2 bushels less corn, and from 200 to 300 lbs. less straw. It would appear, therefore, that even though there might be neither an actual nor a relative deficiency of either of the bases where only one was supplied, the state of combination, and the distribution within the soil, were the more favourable, and consequently the supply was the more easily available, when all were supplied together.

There is here, again, evidence of the fact already frequently illustrated, that a direct supply of a given amount of manure has frequently more effect upon the immediate crop, than an equal or even much greater quantity accumulated and distributed within the soil in the condition of unexhausted residue from previous manuring.

On plots 11, to which neither potass, soda, nor magnesia has been applied, excepting in small quantity in rapeseed in the earlier years, the average annual produce over the last 12 years was more than 5 bushels of dressed corn, and more than 700 lbs. of straw less than on either plots 12, 13, or 14 with either potass, soda, or magnesia, and it was nearly 7 bushels of corn and nearly 1000 lbs. of straw less than on plot 7, where all three were employed in addition to the manures of plot 11.

It is clear that the point of relative deficiency of one or more of the bases had here been reached; and judging from the composition of the ash of the produce of this plot (11) compared with that of plots 12, 13, and 14, it would appear that it is of available potass that the plot has become the most deficient. The crop has generally appeared pretty healthy and luxuriant

during the earlier stages of growth, but of late years the bulk has perceptibly declined, and the proportion of blighted ears has increased in a remarkable degree. Still, the average proportion of corn to straw is higher than in any case with equal or higher amounts of total produce per acre grown by artificial manures. It will be remembered that it was on plots 0, 4, and 5, where, as on these plots 11, phosphoric acid was relatively very abundant, that the highest proportion of corn to straw in the series was obtained. On the other hand, excepting one or two other marked cases of defective manuring, the weight per bushel of the dressed corn of plots 11 was almost the lowest in the series. There was, therefore, with a full average tendency of growth for the production of a fair proportion of corn, at the same time very defective power of maturation.

It has been seen how very ineffective were mineral manures either to bring into activity the unexhausted residue of previous nitrogenous manuring, or to give increase by inducing a greater accumulation of nitrogen by the plant from natural sources; but the results of the series of experiments now under consideration clearly show, how very effective and lasting were the mineral manures employed, to meet the demands made upon the soil for mineral constituents by the use of the nitrogenous manures even in distant succeeding seasons.

*Average Annual Produce by Nitrate of Soda, used alone, or with the Mixed Mineral Manure.*

During the last 12 years plot 9*b* has been manured with nitrate of soda alone, at the rate of 475 lbs. per acre in the first, and of 550 lbs. in each of the 11 succeeding years. The latter amount was taken as equivalent in nitrogen to the 400 lbs. of ammonia-salts applied in so many of the other experiments; but as of late years nitrate of soda of commerce has been purer than formerly, it was probably slightly more than equivalent in nitrogen to the mixture of 200 lbs. of muriate and 200 lbs. of sulphate of ammonia of commerce. During the preceding 8 years 9*b* was manured with ammonia-salts 7 times, once with rape-cake in addition, in the 1st and 5th seasons received superphosphate of lime, and in the 6th was unmanured. It was, in fact, at the commencement of the 12 years, in a condition intermediate between that of plots 10*a* and 10*b* so far as the supply of mineral constituents was concerned; and the effect of the nitrate will be best brought to view by comparing the results with those of these two plots manured with ammonia-salts.

Whilst 400 lbs. of ammonia-salts alone, applied for 19 years on plot 10*a*, and for 13 years on plot 10*b*, gave an average

annual produce over the last 12 years, on the former of  $22\frac{5}{8}$  bushels of dressed corn, and 2603 lbs. =  $23\frac{1}{4}$  cwts. of straw, and on the latter of  $26\frac{7}{8}$  bushels of corn, and 3061 lbs. = about  $27\frac{1}{4}$  cwts. of straw, a nearly identical, but perhaps rather higher, amount of nitrogen applied as nitrate of soda during the 12 years only on plot 9b, gave  $25\frac{7}{8}$  bushels of dressed corn, and 3187 lbs. = nearly  $28\frac{1}{2}$  cwts. of straw. The nitrate has, therefore, given rather less corn, but rather more straw than the ammonia-salts on plot 10b; and whilst it is probable that the nitrate supplied rather more nitrogen than the ammonia-salts, the mineral condition of plot 10b was doubtless more favourable than that of plot 9b.

The conditions and the results were, however, sufficiently near in the two cases to indicate that a given amount of nitrogen will probably, in the average of seasons, and under parallel conditions of soil, give very nearly identical results, whether supplied as nitrate of soda or as ammonia-salts. There is, however, little doubt that nitrogen in the condition of the nitrate becomes more rapidly distributed in the soil, and is more rapidly active. Hence its suitability for Spring dressings; and, hence also in a great measure its tendency to favour great luxuriance of stem and leaf, which, under unfavourable conditions of soil and season, leads to the production of an undue proportion of straw.

On plot 9a, in the 1st year of the twelve 475 lbs., and in the 2nd and 3rd, 275 lbs. of nitrate of soda alone were applied; but during the last 9 years the same amount as on plot 9b (550 lbs.) has been applied, and not alone, but in conjunction with the mixed mineral manure. The results with nitrate of soda and mineral manure on plot 9a, compare best with those of ammonia-salts and mineral manure on plot 7; though, taken over the whole 12 years, 9a received neither quite so much nitrogen nor so much mineral manure as plot 7. Comparing the results as they stand, the average annual produce with the ammonia-salts and mineral manure was  $36\frac{3}{8}$  bushels of dressed corn, and 4212 lbs. = rather over  $37\frac{1}{2}$  cwts. of straw, against  $34\frac{1}{2}$  bushels of dressed corn, and 4426 lbs. =  $39\frac{1}{2}$  cwts. of straw, with the nitrate and the mineral manure; or nearly 2 bushels less corn, but nearly 2 cwts. more straw, equal about 100 lbs. more total produce, with the nitrate than with the ammonia-salts.

Here again, then, when used in conjunction with a mineral manure supplying liberally every constituent likely to be needed except silica, as well as when used alone, the nitrate indicated a tendency to produce more straw and less corn than the ammonia-salts. Indeed, the crops growing on the nitrated plots always showed to the eye during growth, more stem, and broader leaves, than those grown under otherwise parallel conditions with ammonia-salts.



*Average Annual Produce on Plots 15a, 15b, and 19.*

Several incidental points were sought to be determined by this series.

During the whole 12 years, and for several years previously, each plot received, respectively, the same manure year after year. All had the same amount of bone-ash as in the so-called mixed mineral manure, but acted upon by hydrochloric instead of sulphuric acid. Plots 15a, and 15b, had also the same amounts of sulphates of potass, soda, and magnesia as in the mixed mineral manure, but plot 19 had none of these. Further, 15a had also annually 400 lbs. of sulphate of ammonia, and plots 15b and 19, 300 lbs. sulphate of ammonia and 500 lbs. rapeseake.

The object of substituting 400 lbs. of sulphate of ammonia, as on plot 15a, by 300 lbs. of sulphate of ammonia and 500 lbs. of rapeseake on 15b and 19, was to supply nearly the same amount of nitrogen in the three cases, with in the two latter a certain amount of organic matter in addition, yielding by decomposition carbon in an available form to the plant. The amount of rapeseake used would, in fact, contain rather more nitrogen than the sulphate of ammonia it substituted; but, owing to the comparatively slow action of the rapeseake, there would probably be not more annually available until after some years of accumulation. The rapeseake would, of course, also supply a certain amount of mineral constituents. Upon the whole, then, it might be expected that, independently of its superiority or otherwise as supplying carbon-yielding matter, the 500 lbs. of rapeseake used year after year would be somewhat more effective than the 100 lbs. sulphate of ammonia which it substituted.

The effects of these several combinations will be best tested by comparing the results with those of plots 7. The only material difference between the manuring of the latter and that of 15a was, that in the manure of 15a the bone-ash was acted upon by hydrochloric acid instead of sulphuric acid, and there was about 8 per cent. or about one-twelfth less ammonia. The result was an average of rather more than 3 bushels of dressed corn, and of 417 lbs. = about  $3\frac{3}{4}$  cwts. of straw, less than on plots 7. About one-half of this deficiency may be attributed to the less amount of ammonia supplied, the remainder only being due to the less effective condition of the bone-ash acted upon by hydrochloric instead of sulphuric acid.

Plot 15b, manured exactly as 15a, excepting that 100 lbs. of the sulphate of ammonia was replaced by 500 lbs. of rapeseake, gave more nearly the amount of produce of plots 7, yielding  $1\frac{3}{4}$  bushel of dressed corn, and rather more than 2 cwts. of straw, more than 15a, though still  $1\frac{1}{2}$  bushel of corn and 184 lbs. of

straw less than plots 7. There is no evidence, therefore, of any marked effect from the carbonaceous organic matter of the rape-cake.

Plot 19 was manured during the 12 years in the same way as 15*b*, with the exception that the sulphates of potass, soda, and magnesia, were omitted. It should be further observed, that whilst during the first 8 years of the 20, plot 15*a* received of potass in manure nearly, and 15*b* over, 400 lbs. more, plot 19 received nearly 200 lbs. less, than was removed in the crops. There was, therefore, a considerable relative deficiency of potass in the soil of plot 19, and it gave an annual average produce of nearly  $3\frac{1}{4}$  bushels of dressed corn, and about  $4\frac{1}{2}$  cwt. of straw, less than plot 15*b*.

It is worthy of remark that the produce of plot 19, like that of plots 11, where also the supply of phosphoric acid was relatively large, showed a comparatively high proportion of corn to straw, notwithstanding the deficient amount of total produce due to the relative exhaustion of potass in both cases. It may also be mentioned, that the straw has frequently been observed to be finer, the grain more thin-skinned, and the crop more evenly ripened, where the bone-ash has been acted upon by hydrochloric instead of sulphuric acid.

From the results of this series it may be concluded—that there is no practical or economical advantage in rendering bone-ash soluble by the expensive hydrochloric instead of the cheaper sulphuric acid; that rape-cake benefits the wheat crop by its supply of nitrogen and of mineral constituents, but immaterially by the supply of available carbon within the soil from decomposing organic matter; and that where a liberal phosphatic and nitrogenous manure was used for many years, the available supply of potass to the growing crop became very injutiously diminished.

#### *Summary Statement of the Results of the last 12 Years.*

1. The average annual produce of wheat per acre, over the last 12 of 20 years of the growth of the crop on the same land, and of more than 20 since the application of manure of any kind, was  $15\frac{1}{2}$  bushels of dressed corn, and there was no material diminution in the yield in the later years: the proportion of corn to straw was as high as in the produce by farmyard manure, and higher than in the majority of cases with the more productive artificial manures, but the weight per bushel of dressed corn was very low.

2. Farmyard manure, applied every year in amount containing considerably more of every constituent than was removed in the crop, increased the average annual produce to nearly  $35\frac{1}{2}$  bushels

of dressed corn, or by about 20 bushels per acre per annum, and gave the highest weight per bushel of dressed corn in the series, but the proportion of corn to straw was no higher than in the unmanured produce. The annual produce was very much higher during the latter than during the earlier half of the 20 years, but it increased much less rapidly during the last few years.

The questions arise—In what constituent, or class of constituents, was the unmanured land deficient? and—to what constituent, or class of constituents, supplied by the farmyard manure, was its increase of produce due?

3. A complex mineral manure (plot 5), supplying annually more of potass, soda, magnesia, lime, sulphuric acid, and phosphoric acid, than was taken off in the crops (but no silica), even though used after several years of accumulation of unexhausted residue from previous ammoniacal (and mineral) manuring, gave annually only about 3 bushels increase over the unmanured produce, and nearly 17 bushels less than the produce by farmyard manure. The proportion of corn to straw was, however, higher, but the weight per bushel of dressed corn lower, than in the produce by the farmyard manure.

4. Ammonia-salts alone (plot 10a), employed for 19 consecutive years after an application of mineral manure supplying of potass about as much as would be removed in the first 3, and of phosphoric acid about as much as would be removed in the first 5 of the 20 years, gave a considerable, but gradually diminishing, average annual increase (over the produce without manure)—amounting over the first 9 years to rather more than 9 bushels, over the last 10 to  $7\frac{1}{4}$  bushels, and over the 12 to which our summary more particularly refers, to rather more than 7 bushels.

5. As ammonia-salts alone increased the produce very much more than mineral manure alone, and did so for a long series of years, it is obvious that the practically exhausted land contained a considerable excess of available mineral constituents relatively to the available supply of nitrogen from soil and atmosphere. The results further show, that the plants growing under the influence of a liberal artificial supply of mineral constituents appropriated scarcely any more nitrogen from natural sources than those growing on the unmanured land.

6. The same mineral manure which alone gave scarcely any increase, and the same amount of ammonia-salts (400 lbs.) which alone gave so much less increase than the farmyard manure, and in a diminishing rate from year to year, gave when employed together an average annual increase of about 21 bushels of corn and  $22\frac{3}{4}$  cwts. of straw over the unmanured produce, or about 1 bushel of corn and 3 cwts. of straw over that by the farmyard manure. Larger additions of ammonia-salts to

the mineral manure gave larger amounts of increase, but at a very much diminished rate in proportion to the ammonia employed. Thus, a manure containing ammonia-salts and soluble mineral constituents, but neither silica nor organic matter yielding carbonic acid or other compounds of carbon within the soil, gave, for many consecutive years, more produce than an amount of farmyard manure supplying annually more of every mineral constituent, including silica, more nitrogen, and more carbon, than the total produce removed from the land.

7. Nitrate of soda, in amount containing about the same quantity of nitrogen as 400 lbs. of ammonia-salts, used in conjunction with the same mineral manure, gave nearly as much corn, and more straw and total produce, than the farmyard manure.

8. No beneficial effect resulted from the use as manure of organic matter yielding by decomposition carbonic acid, or other compounds of carbon, within the soil. In fact, although a crop of wheat equal to the average produce by farmyard manure would contain about 2000 lbs. of carbon, the plant seems practically independent of any supply of carbon by manure, being able to assimilate this large amount, either by its roots or its leaves, from the atmospheric sources, if only mineral constituents and nitrogen be supplied to the soil in sufficient quantity and in available form. Other cultivated plants of the Gramineous family, such as barley, and the grasses of our meadows and pastures, appear to be equally independent of a supply of carbon by manure. Root-crops, and probably some other of our agricultural plants are, on the contrary, very dependent on a supply of carbon from decomposing organic matter within the soil.

9. The carbonaceous organic matter of the farmyard manure used in the experiments, if not without effect, was obviously at any rate unnecessary; and the increase obtained by the use of that manure was no doubt mainly due to its large, but comparatively slowly available, supply of ammonia, or nitrogen in some other form, and mineral constituents.

#### IV. AMOUNT OF INCREASED PRODUCE OBTAINED FOR A GIVEN AMOUNT OF AMMONIA SUPPLIED IN MANURE.

It has been shown that full crops of wheat cannot be grown unless there be a liberal available supply of mineral constituents within the reach of the plant, and further, that such supply is ineffective unless ammonia, or nitrogen in some other available form, be also liberally provided within the soil. In our concluding observations reference will be made to the various means at the farmer's command of keeping up the necessary supplies of both the mineral constituents and nitrogen. But as the purchase



of ammoniacal manures and nitrates constitutes one of the recognised sources of nitrogen for the growth of wheat, the practical question arises—how much increase may be calculated upon from the use as manure of a given amount of ammonia, or of an equivalent amount of nitrogen in some other available form? Table XXXI. (see following page), brings together a vast amount of evidence on this point. It shows the amount of ammonia in manure (or of nitrogen as nitrate reckoned as ammonia) that was required for the production of 1 bushel (or 60 lbs.) increase of wheat grain, with its proportion of straw, on the most important plots, in each of the last 12 years of the experiments.

As the productive effect of a given amount of ammonia depends very much upon the available supply of the necessary mineral constituents within the soil, and as artificial nitrogenous manures of course should not be, and seldom are in practice, employed if the supply of them be deficient, the Table is arranged to show, not the amount of ammonia required for each bushel obtained beyond the produce without manure, but over that by the mixed mineral manure, which being higher, leaves so much the less to be reckoned as increase due to the action of the ammonia supplied. Then, again, instead of taking the actual number of bushels of increase of dressed corn each year, which would represent very different amounts according to the varying weight per bushel from year to year, the number of bushels is, in all cases, calculated by dividing the number of lbs. of increase of corn by 60. For the purposes of the Table, therefore, every 60 lbs. of increase over the produce by the mixed mineral manure is supposed to represent 1 bushel.

Many years ago, in papers in this Journal, we stated, as a provisional estimate deduced from the results of the experiments now under consideration so far as they had then proceeded, that the farmer might assume, for practical purposes, that he would, on the average of seasons, get 1 bushel of wheat and its proportion of straw beyond the produce of the soil and season, for each 5 lbs. of ammonia applied as manure for the crop. This estimate was founded upon results obtained where the mineral constituents were not unduly exhausted, and the amounts of ammonia supplied were not excessive; that is, under conditions likely to accord with those most frequently occurring in common practice.

The statement met with much ridicule from Baron Liebig, who said that it was “a mere stroke of fancy.” Whether the statement in question, or this condemnation of it, partakes most of “a mere stroke of fancy,” may be judged by the record of facts given in this Section.

50 lbs. of ammonia, or its equivalent of nitrogen, would be supplied in rather under 2 cwt. of commercial sulphate, or  $1\frac{3}{4}$

TABLE XXXI.—Quantity of Ammonia in Manure (or of Nitrogen as Nitrate reckoned as Ammonia) required to produce 1 bushel (= 60 lbs.) increase of Wheat-grain, and its proportion of Straw, according to the quantity applied per Acre, to the available supply of Mineral Constituents within the soil, and to the Season.

Plots.	Manures per Acre, per Annum, for 12 Years, 1852-63. (For further particulars see Appendix, Table IX., and Notes, pp. 162-3; and for Manures previous to 1852, see Appendix—Tables I-VIII., pp. 146-160.)	FIRST 6 YEARS.						SECOND 6 YEARS.						AVERAGE.		Plots.
		1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	First 6 Years, 1852-57	Second 6 Years, 1858-63	
														1852-57	1858-63	
6 (a & b)	200 lbs. Ammonia-salts (1), and Mixed Mineral Manure (2)	12.45	7.13	4.57	4.76	5.68	4.43	4.79	5.40	5.85	4.77	4.66	2.42	lbs. 5.59	lbs. 4.39	6 (a & b)
7 (a & b)	400 lbs. Ammonia-salts, and Mixed Mineral Manure	10.42	7.86	4.31	6.25	5.61	4.35	4.68	7.33	8.76	5.19	5.35	2.72	5.86	4.95	7 (a & b)
8 (a & b)	600 lbs. Ammonia-salts, and Mixed Mineral Manure	14.49	11.47	5.70	10.32	7.23	5.52	6.12	11.82	10.54	7.61	6.64	3.88	8.01	6.80	8 (a & b)
16 (a & b)	800 lbs. Ammonia-salts, and Mixed Mineral Manure . . . . .	17.37	13.08	7.03	12.54	9.75	7.06	7.99	16.29	12.59	9.11	10.72	5.07	9.98	9.00	16 (a & b)
17 (a & b) or 18 (a & b)	400 lbs. Ammonia-salts, in alternation with Mixed Mineral Manure	12.09	..	4.67	..	7.98	..	6.26	..	10.72	..	9.90	..	6.92	6.69	17 (a & b) or 18 (a & b)
10 (a)	400 lbs. Ammonia-salts alone (19 years, 1845-63)	22.47	13.89	9.15	44.44	20.12	16.89	25.84	..	..	..	17.30	4.62	20.52	22.74	10 (a)
10 (b)	400 lbs. Ammonia-salts alone (13 years, 1851-63)	20.70	20.20	6.12	9.16	11.53	8.29	10.56	26.67	42.55	..	12.24	3.83	10.39	12.16	10 (b)
11 (a & b)	400 lbs. Ammonia-salts, and Superphosphate of Lime (3)	16.14	13.55	4.80	50.98	7.81	6.30	7.23	15.60	16.28	13.54	9.85	3.47	8.92	8.25	11 (a & b)
12 (a & b)	400 lbs. Ammonia-salts, Superphosphate of Lime, and Sulphate of Soda	13.50	8.25	4.29	6.73	6.79	4.70	4.98	7.40	8.68	5.96	6.33	2.73	6.30	5.24	12 (a & b)
13 (a & b)	400 lbs. Ammonia-salts, Superphosphate of Lime, and Sulphate of Potass	14.11	7.81	4.51	7.00	7.36	4.74	5.07	7.63	8.98	5.14	6.86	2.78	6.58	5.27	13 (a & b)
14 (a & b)	400 lbs. Ammonia-salts, Superphosphate of Lime, and Sulphate of Magnesia . . . . .	12.90	8.16	4.45	6.71	6.18	4.70	4.93	7.61	9.18	5.54	7.20	2.73	6.31	5.77	14 (a & b)
9 (a)	550 lbs. Nitrate of Soda, and Mixed Mineral Manure (1)	9.63	32.68	3.33	7.67	7.39	4.59	5.10	11.30	6.39	5.47	3.80	2.62	6.59	4.73	9 (a)
9 (b)	550 lbs. Nitrate of Soda alone (5)	11.36	120.48	6.49	13.19	12.71	7.91	22.83	43.86	25.45	..	11.30	4.19	11.29	14.73	9 (b)

(1) "Ammonia-salts"—equal parts Sulphate and Nitrate of Ammonia of commerce.

(2) "Mixed Mineral Manure"—Superphosphate of Lime, and Sulphates of Soda, Potass, and Magnesia.

(3) "Superphosphate of Lime"—4 parts Bone-ash, and 3 parts Sulphuric Acid, 89 gr. 17.

(4) 92—The Mixed Mineral Manure not applied until 1854-5, and only 475 lbs. Nitrate of Soda for 1852, and 275 lbs. for 1853 and 1854.

(5) 90—Only 475 lbs. of Nitrate of Soda for 1852.

cwts. of commercial muriate of ammonia, in about  $2\frac{3}{4}$  cwts. of genuine Peruvian guano, or in rather more than  $2\frac{1}{4}$  cwts. of nitrate of soda. These amounts are more than are usually employed in common practice for the wheat crop; and most practical men would consider double these quantities to be very heavy, if not excessive dressings.

In bringing to bear upon the question under consideration the additional experimental evidence now at command, we shall assume, therefore, that the results obtained by the use, per acre, of 50 or 100 lbs. of ammonia (or their equivalent of nitrogen as nitrate) most nearly represent those which may be expected in ordinary practice; and further, that the results obtained by these amounts in the cases where the mineral constituents (unless silica) are not in relative defect, are also such as are most likely to be obtained in ordinary farm practice. Accordingly, we adopt for our purpose, the results obtained on plots 6 with 200 lbs., and on plots 7 with 400 lbs. of ammonia-salts (containing, respectively, 50 and 100 lbs. of ammonia) in each case used in conjunction with the mixed mineral manure; and these will be taken as the standards by which to compare the effects of larger amounts of ammonia with the same mineral manure, or the same amounts of ammonia under less favourable conditions as to the supply of mineral constituents.

It will be observed, that, almost uniformly, rather less ammonia was required to produce 60 lbs. increase of corn on the average of the last 6, as compared with the first 6 of the last 12 years. It will, perhaps, be said that the apparently better effect during the later years is in reality due to the unexhausted residue of the supplies in the earlier years. Evidence enough has been adduced showing the limit of the effect of such unexhausted residue; and, whilst admitting that a portion of the difference in favour of the later years may be attributed to previous accumulation, there can be no doubt, as has been shown, that the last 6 seasons were themselves more favourable than the preceding 6, and that to this cause a considerable portion of the difference is really due. Subject, then, to some correction on the score of accumulation, the average result over the 12 years may doubtless be taken as pretty closely representing the average effect of a given amount of ammonia, according to the amount of it employed, and to the favourable or unfavourable condition of the soil in regard to the supply of mineral constituents.

When 50 lbs. of ammonia per acre were annually applied in conjunction with a complex mineral manure, excluding silica (plot 6), the average annual result was, that 4.86 lbs. of ammonia were required to produce 60 lbs. increase of corn, with its equivalent of straw. This amount of ammonia, as has been said,

is as much, if not more, than would be generally employed; and it is seen that, with it, the quantity expended for each bushel of increase was very nearly the previously assumed amount of 5 lbs. When double the quantity per acre was used, which would be much more than appropriate for most soils and seasons, rather more than 5 lbs. (5·37), when 3 times the amount 7·35 lbs., and when 4 times 9·47 lbs., were required. Thus, when excessive amounts of ammonia are employed, much more is expended for the production of a given amount of immediate increase of crop, than when only moderate quantities are used; and it has been seen how very slowly the excess may become available in after years.

Still more unfavourable was the result when 400 lbs. of ammonia-salts (equal 100 lbs. ammonia) were employed under defective conditions as to the supply of mineral constituents. On plots 17 and 18, on one or the other of which that amount was each year employed succeeding the application of the mixed mineral manure in the preceding year, it required 6·69 lbs. of ammonia to produce 60 lbs. of increase of corn with its proportion of straw. On plots 12, which might be deficient in available supply of magnesia and possibly of potass, on plots 13 which were probably relatively deficient in magnesia, and on plots 14 probably in the later years in potass, the amount of ammonia required was from 5·76 to 5·85 lbs. instead of only 5·37 lbs. on plots 7, where, with the same amount of ammonia-salts, the mineral manure each year supplied all three bases—potass, soda, and magnesia. Then again, on plots 11, to which no direct supply of either potass, soda, or magnesia, had been made throughout the 20 years (only small quantities in rape-cake) 8·57 lbs., on plot 10*b*, with a deficiency almost certainly of potass and phosphoric acid, and probably of magnesia also, 11·2 lbs., and on plot 10*a*, with a still greater deficiency of mineral constituents, 21·57 lbs., or more than 4 times the normal amount of ammonia, were required to be provided for the production of 60 lbs. increase of corn, and its proportion of straw.

Very similar results were obtained when nitrogen, about equal in amount to that in 100 lbs. of ammonia, was supplied in the form of nitrate of soda, instead of ammonia-salts. When the nitrate was used year after year with the mixed mineral manure (plot 9*a*), it required nitrogen about equal to that in 5·41 lbs. of ammonia to produce 60 lbs. increase of corn and its proportion of straw, against 5·37 lbs. when ammonia-salts were used (plot 7). But when the same amount of nitrate was used without the mineral manure, an amount of nitrogen averaging about 12·8 lbs. of ammonia was annually expended to produce the same result.

It may be observed, too, that assuming the farmyard manure



to have contained only a moderate proportion of nitrogen, the amount expended for the production of a given quantity of increase corresponded to considerably more ammonia than was required when nitrogen equal to 50, or even 100 lbs., of ammonia was employed as ammonia-salts, or nitrate of soda, in conjunction with the mixed mineral manure, notwithstanding that the latter contained no silica, a constituent so liberally provided in the farmyard manure. It would appear, therefore, that the practical results have not yet been materially affected for want of available silica where the mixed mineral manure was employed. There is, however, evidence in our analytical results that silica has become relatively deficient where it has not been supplied in the manure.

Very striking indeed, then, is the difference of effect upon the immediate increase, of a given amount of nitrogen in manure, whether used as ammonia-salts or nitrate, according to the available supply of mineral constituents within the soil; and with the overwhelming evidence before him, which such a comprehensive summary of experimental results on the point affords, the practical man will not fail to see that he not only very injuriously further reduces his immediately available supply of mineral constituents, but also pays very dearly for his increase, if he seek to obtain it by means of purely nitrogenous manures, when his soil is already unduly exhausted of mineral constituents.

Equally, if not more, striking, is the difference of effect of a given amount of ammonia in one season as compared with another. Where the mineral condition is the most defective, there the result of a given amount of ammonia is the most reduced below the average in a bad season. Leaving the reader to the study of all such abnormal cases in the records given in the Table, it will be sufficient here to direct attention to the great difference of effect according to season even under the more favourable conditions as to the amount of ammonia employed, and as to the associated supply of mineral constituents.

The results of plot 6, where only 50 lbs. of ammonia were applied each year, and always in conjunction with the mixed mineral manure, will well illustrate the point in question. Whilst, taking the average of the 12 years, it required 4.86 lbs. of ammonia in manure to yield 60 lbs. of increase of corn and its proportion of straw, in the remarkably productive season of 1863 it required only 2.42 lbs., but in 1853, 7.13 lbs., in 1860, 8.85 lbs., and in 1852, 12.45 lbs. The amount of produce was, indeed, lower in 1853 than in 1852; but as the deficiency was very much greater with the mineral manure alone (upon the produce of which the increase is calculated) than where the

ammonia-salts were also used, the amount reckoned as increase due to the ammonia was by so much the greater in 1853, and hence the better result for a given amount of ammonia in that year than in 1852.

To conclude on this point: Great as is the difference of effect of a given quantity of ammonia, according to the amount applied per acre, to the mineral condition of the soil, and to the season, still, when only moderate quantities were used, when there was a sufficient supply of mineral constituents, and taking the average of many seasons—that is, under the conditions the most comparable with those of the average of common practice—the result was, in marked accordance with our early estimate, that almost exactly 5 lbs. of ammonia were required to be expended to obtain an increase of 1 bushel of wheat grain, and its proportion of straw.

#### V. CONCLUDING OBSERVATIONS; SHOWING THE PRACTICAL BEARINGS OF THE RESULTS.

Referring the reader to the fuller summaries already given, of the conclusions arrived at in reference to each separate branch of the subject, it only remains, in bringing this paper to a close, very briefly to recapitulate a few of the most prominent facts elicited, and to show their connexion with, and bearing upon, the ordinary farm practice of this country.

1. On a soil of not more than average wheat-producing quality, and taken for experiment after a course of 5 crops since the application of manure, wheat has been grown successfully, without manure, and with different descriptions of manure, for 20 years in succession.

2. Without manure, the produce of dressed corn was, in the first year, 15 bushels per acre; in the last,  $17\frac{1}{4}$  bushels; and, taking the average of the 20 years,  $16\frac{1}{4}$  bushels.

3. With farmyard manure, applied every year, the produce was, in the first year,  $20\frac{1}{2}$  bushels; in the last, 44 bushels; and, on the average of the 20 years,  $32\frac{1}{2}$  bushels.

4. With artificial manures, the highest produce was, in the first year,  $24\frac{1}{4}$  bushels; in the last,  $56\frac{1}{2}$  bushels; and, taking the average of the 20 years,  $35\frac{3}{4}$  bushels, or considerably more than the average produce of Great Britain when wheat is grown in the ordinary course of agriculture in rotation; and also considerably more than was obtained in the same field by an annual application of farmyard manure.

5. Mineral manures alone, though applied in the soluble form, increased the produce scarcely at all; that is, they did not enable the plant in any material degree to assimilate more nitrogen and

carbon from atmospheric sources, than when it was grown on the practically exhausted unmanured land.

6. Nitrogenous manures alone, increased the produce very considerably for many years in succession; hence, the soil in its practically exhausted condition was relatively much richer in available mineral constituents, than in available nitrogen.

7. The largest crops were obtained when mineral and nitrogenous manures were employed together; and it was by such mixtures, even though they supplied no silica (nor carbon), that the produce by farmyard manure was far exceeded, although the latter supplied, not only both silica and carbon, but all other constituents in larger quantity than they were removed in the crops.

The question arises—Will any conclusions drawn from these results regarding the character of the exhaustion induced by a course of cropping in this particular soil, and consequently regarding the description of manure required before it will again produce full crops of wheat, be at all applicable to any other soil, or to soils generally?

Baron Liebig, although he profusely illustrates his own views by reference to field experiments, and even to isolated results of our own, if by unfair representation they can be made to serve his purpose, and although it is doubtless by the evidence of such experiments that he has been led to his present, and on many points greatly amended, views, at the same time denies the utility of field experiments generally, and of our own in particular, as a basis of deduction regarding even a neighbouring field, and, still more, a field in any other locality. Other authorities look at field experiments in a very different light. Only a few weeks since, in a lecture delivered before the members of the Highland and Agricultural Society of Scotland, at Stirling, Professor Anderson took as his subject the importance and the best mode of promoting field as well as other experiments in connexion with agriculture.

With regard to the particular soil upon which the experiments which form the subject of this Report were made, Baron Liebig, according to the exigency of his argument, has maintained alternately that it was so rich, and so poor, in mineral constituents, that it was utterly unfit for the purposes of our investigation. To aid the judgment of those who may wish to consider the subject in the spirit of candour proper to an important practical and scientific inquiry, it may be well to indicate how far the results, briefly stated above, are consistent with those obtained in direct experiments in an adjoining field, and on soils of very different descriptions in other localities, and also how far they are consistent with the common experience of practical agriculture in this country.

The following Table (see page 493) shows, side by side, the average annual produce obtained, without manure, by the "mixed mineral manure" alone, by 400 lbs. ammonia-salts alone, and by the "mixed mineral manure" and 400 lbs. ammonia-salts together—

1. During 8 years (1856-63) in the experimental field in which the results recorded in this paper were obtained.

2. During the same 8 years in an adjoining field, after several wheat crops had previously been taken without manure.

3. During 3 years (1852-54) at Holkham, in Norfolk, on a soil described as a light, thin, and rather shallow, brown sand-loam, but resting upon an excellent marl containing a large quantity of calcareous matter, and which had grown wheat in the preceding year with the same manures, and white turnips manured with farmyard dung and guano (of which both tops and roots were removed), in the year preceding the wheat.

4. Over 4 years (1856-59) at Rodmersham, Kent, on a soil described as a mixed clay, upon a chalk subsoil lying from 4 to 6 feet below the surface, and which had grown—in 1853, turnips manured with 2 cwts. of guano and 3 cwts. of superphosphate of lime per acre, the crop being fed on the land; in 1854, barley; and in 1855, beans with stable dung.

The coincidence of the results obtained in the two fields at Rothamsted is most striking; and when the known differences in the condition of the comparable plots in the two cases are taken into consideration, even the differences, such as they are, only afford additional evidence of the consistency of the indications. Thus, in Broadbalk field, the mineral manure alone succeeded heavy dressings of nitrogenous manure, whilst in the other it did not; and, accordingly, there is rather more produce in the former than in the latter. Again, the ammonia-salts had, in Broadbalk field, been used alone for several years on the same plot prior to the period taken into the calculation; and hence, with the greater exhaustion of mineral constituents in its case, there was rather less produce. The results without manure, and with the mixed mineral manure and ammonia-salts together, are so nearly identical in the two cases as to call for no remark.

The Holkham soil and subsoil were totally different in character to those at Rothamsted; the condition at the commencement as affected by recent manuring was rather higher, and two of the seasons over which the averages are taken were unfavourable, and one very favourable for the wheat crop. With these great differences of circumstance in almost every particular, we still find, as at Rothamsted, very little increase by mineral manure alone, considerably more by ammonia-salts alone, and more still by mixed mineral manure and ammonia-salts together.

The Rodmersham soil and subsoil were more nearly allied in



TABLE XXXII.—Results of Experiments on the GROWTH of WHEAT by different Manures, on different Soils, in different Localities, and in different Seasons.

MANURES APPLIED EACH YEAR.	AVERAGE ANNUAL RESULTS.			
	Rothamsted, 8 Years; 1854-61.		Holkham, Norfolk; 3 Years, 1852-54.	Rodmers- ham, Kent; 4 Years, 1856-59.
	Broadbalk Field.	Hoos Field.		

Dressed Corn, per Acre ; in Bushels and Pecks.

Unmanured .. .. .	16 0	15 0	17 $3\frac{3}{4}$	25 $2\frac{1}{4}$
Mixed Mineral Manure, alone .. .. .	19 0	16 $0\frac{1}{2}$	19 $0\frac{1}{2}$	28 2
Ammonia-salts, alone .. .. .	23 $0\frac{3}{4}$	26 $0\frac{1}{2}$	27 $0\frac{3}{4}$	31 $1\frac{3}{4}$
Mixed Mineral Manure, and Ammonia-salts	38 $1\frac{3}{4}$	37 $1\frac{1}{2}$	32 $2\frac{1}{2}$	33 2

Weight per Bushel of Dressed Corn ; lbs.

Unmanured .. .. .	57·0	57·7	61·3	59·4
Mixed Mineral Manure, alone .. .. .	58·4	58·5	62·1	60·1
Ammonia-salts, alone .. .. .	56·0	56·9	59·6	58·5
Mixed Mineral Manure, and Ammonia-salts	58·9	58·0	62·4	57·8

Total Corn, per Acre ; lbs.

Unmanured .. .. .	990	926	1111	1565
Mixed Mineral Manure, alone .. .. .	1192	987	1202	1760
Ammonia-salts, alone .. .. .	1471	1618	1636	1917
Mixed Mineral Manure, and Ammonia-salts	2407	2295	2055	2020

Straw (and Chaff), per Acre ; lbs.

Unmanured .. .. .	1625	1459	1298	3343
Mixed Mineral Manure, alone .. .. .	1804	1528	1700	3949
Ammonia-salts, alone .. .. .	2536	2705	2240	4788
Mixed Mineral Manure, and Ammonia-salts	4176	4016	2838	5696

character to those of Rothamsted ; but the condition as affected by recent manuring was very much higher. In fact, the land, so far from being at the commencement in a practically exhausted condition requiring liberal manuring, was described as being already in a well cultivated and fertile state, and prepared for the wheat crop. The quantities of ammonia actually applied were, therefore, obviously very excessive. The result, under these circumstances, was, as might be expected, much higher produce

without manure, and smaller amounts of increase, especially of corn, with the nitrogenous manures. Still, the general character of the average results over the four years, is the same as in the other cases. There is but a small amount of increase by the mixed mineral manure alone, much more by ammonia-salts alone, and more still by the mixed mineral manure and ammonia-salts together.

But, independently of the evidence of direct experiment, such as is afforded in the results above referred to, we would here reiterate the opinion given in substance in former papers, and founded on a very extensive acquaintance with the practical experience of farmers in the use of artificial manures in every district of Great Britain for many years past, that, in 99 cases out of 100 in which wheat grown in the ordinary course of agriculture requires further manuring, it would be much more increased by the application of nitrogenous than of purely mineral manures; in other words, that in the ordinary course of agriculture with rotation, as practised in this country, the supply of mineral constituents immediately available for the wheat crop, is almost invariably in excess relatively to the immediately available supply of nitrogen from the atmosphere, or the accumulated stores within the soil itself. Furthermore, with few exceptions, the worse the so-called "condition" of the land, that is, the more it is in the agricultural sense exhausted, the more striking would be the effect of exclusively nitrogenous compared with that of exclusively mineral manures.

What, then, are the common practices of British agriculture which lead to this result?

Let us take as an example, as we have done before, the practice of the so-called four course rotation—of roots, barley, clover (or beans), and wheat. Let us further assume, for the sake of argument, that on the average 30 bushels of wheat, 35 bushels of barley, and the meat from the consumption of 10 tons of swedes, and clover equal to 6000 lbs. of clover hay (or 1500 lbs. of bean corn), are the products sold from each acre of the farm in the 4 years, and that the straw of the corn crops, and the excrements from the animals feeding on the roots and the clover or beans are retained on the farm as manure, and returned periodically to the land. Confining attention, for the sake of simplicity of illustration, to those mineral constituents which, so far as existing knowledge goes, are the most likely to become relatively deficient in the majority of soils, it may be estimated that, under such a course, the average annual loss per acre by the sale of corn and meat, would be of potass from  $4\frac{1}{2}$  to 5 lbs., of phosphoric acid from 7 to 8 lbs., and of silica about 3 lbs.

But all practical men will admit that the amounts of produce here assumed to be exported from each acre, or equivalent amounts in other forms, could only be so under one of two conditions. Either the soil must be naturally a very fertile one, or the produce must be kept up by means of purchased cattle-food or artificial manures. In the case of a soil so fertile as to have yielded for any considerable number of years the average produce supposed without assistance from import, it may well be questioned whether it, with its workable subsoil, would not be competent to yield annually, by decomposition, the necessary amounts of the mineral constituents mentioned, and if of them of others also, for an all but indefinite period. In the other case—that in which the produce is kept up by means of the import of cattle-food or artificial manure, or of part one and part the other—the loss of the constituents in question derived from the soil itself will, of course, be by so much less than the amounts assumed above, and that of others will be also reduced. There can indeed be little doubt that, in actual practice, the loss to the soil itself, by the sale of corn and meat, is generally more nearly one-half, and frequently less than one-half, of the above assumed amounts of the constituents mentioned; and that of others will be less accordingly.

So far as the purchase of food for stock was relied upon, no selection could well be made from the current supplies in the market, that would not bring upon the farm more of the mineral constituents than the increase of produce due to the manure obtained from it would remove from the land in the form of corn and meat. In fact, to increase the sales of corn and meat by the import of cattle-food as generally practised, is to increase, and not to diminish, the amount of available mineral constituents within the soil. If, on the other hand, the produce were kept up by means of artificial manures, the rules of selection among intelligent practical men are such, that almost invariably much more of phosphoric acid at any rate, would be brought upon the land, than would be removed from it in the increase of corn and meat due to the use of the imported manures.

In the case supposed without import, it is probable that, in the majority of instances, phosphoric acid would be the most liable to become deficient in relation to other constituents. The sources of phosphoric acid developed in recent years, promise, however, to answer to any demand that seems likely to be made upon them to remedy such exhaustion of it as the present agricultural practices of the country induce.

In the case of imports, on the other hand, especially where they consisted chiefly of the current artificial manures rather than

of cattle-foods, potass would be the most likely to become deficient. The sources of potass in the market are, indeed, not large, and its price is high. Still, it would be a very economical manure if it increased the immediate produce by an amount containing anything like the proportion of that supplied, which is obtained in the case of nitrogen when nitrogenous manures are employed. But current practices have certainly not yet so far reduced the relative supply of potass in our soils as to render the application of direct potass-manures to the wheat crop at all profitable to the farmer. The results detailed in this paper clearly show, however, that salts of potass are effective enough on the growth of wheat when the immediately available supply within the soil is really unduly exhausted relatively to that of other mineral constituents, provided only that there be no deficiency of available nitrogen. In the case of Leguminous crops, indeed, potass-manures will frequently greatly increase the amount of nitrogen assimilated over a given area without any direct supply of the latter by manure. And should it happen that our modern system of town drainage should lead to such an exhaustion of our arable lands of their due proportion of available potass, that potass-manures from without should become really effective, there can be little doubt that a sufficient economical source of supply would soon supervene on such a demand.

There is, of course, no question, that if the manurial constituents resulting from the consumption of the corn and meat sent into our towns could be returned to the land whence they came, its produce would be considerably increased; for with the mineral constituents there would always be associated nitrogen, in amount which would serve to render effective a considerable portion of all, if not the whole of some, of those constituents. If, however, human excretal matters continue to be diluted with water to the extent recognised by the growing system of urban defecation, and if dilute liquid sewage cannot be distributed in small quantities over large areas at a much lower cost to the farmer than has yet been proposed, there is little hope that the manurial constituents derived from the human food sent into our towns can be re-distributed over the area from which they came. Indeed, having regard to the inapplicability of dilute liquid sewage to arable land, except in small quantities and at particular seasons, and to the assumed cost of distribution, it appears probable that the most profitable mode of utilisation of sewage will be, to limit the area by applying the greater part, if not the whole, to permanent or other grasses, laid down to take it the year round, trusting mainly to the periodically broken up rye-grass land,



and to the application to arable land of the solid manure resulting from the consumption of the sewaged grass, for obtaining other produce than milk and meat by means of sewage.

In the illustrations given above, therefore, it is sought to convey an approximate idea, on the one hand of the utmost extent, and on the other of the probable limit, of the loss to which our arable soils are subject by the sale of corn and meat, supposing the mineral constituents be not returned to the land whence they came. Confining attention to this object, we necessarily leave out of view the cases in which roots, hay, or straw, are largely sold, for, in such, compensation is generally made by the return to the land of town manures of some kind. If this be not done the loss of mineral constituents will, of course, be very considerable.

In view of the facts above adduced, we think it may safely be concluded, that the modern practices of this country, taken as a whole, do not tend to the injurious exhaustion of the mineral constituents in anything like the degree that has been assumed by some. Further than this, we think the evidence is more in favour of the supposition that, in a great majority of our soils, they are, by the combined aid of progressive liberation, and of restoration from without, becoming, in the course of cultivation, richer rather than poorer in immediately available mineral constituents relatively to immediately available nitrogen. So far as this is attained at the expense of the constituents of the soil itself, there is, of course, the less to fall back upon within a given depth from the surface. But, it surely cannot be denied, that if there really is an annual liberation of mineral constituents in available form for the growth of plants, at least a portion of this may, with propriety, be sold off the farm for good and all.

The exact amount of annual loss of mineral constituents which any soil, with its workable subsoil, can permanently support without injury, cannot, indeed, be proved. But such evidence as is at command goes to show, that, under the conditions at present existing, the nature and extent of the loss to which our soils are subject are such, that the majority are deficient of available nitrogen rather than of available mineral constituents, so far as the requirements for full crops of the cereal grains are concerned.

Insisting strongly, then, as we have always done, upon the absolute necessity of a full supply of available mineral constituents within the soil, relatively to that of nitrogen, we still believe that, in the actually existing conditions of British agriculture, it is not they, but the available nitrogen, that is generally found to be relatively deficient.

What then, are the sources of available nitrogen within the

soil, to which the farmer must look for the production of good crops of wheat?

In former papers in this Journal, we have pointed out that his chief means to this end was the adoption of a suitable rotation of crops—alternating with his corn the so-called “green,” “fallow,” or “fodder” crops, an important office of which it is to collect from natural sources, or to conserve on the farm in the form of manure, available nitrogen for the increased growth of the saleable cereal grains. We have further maintained that, as either by bare fallow, or a rotation of crops, with the consumption of the fallow crops and the retention of the straw on the farm, the accumulation of available mineral constituents will generally be in excess of the available nitrogen, it is the amount of the latter, rather than of the former, that will be the measure of the increased produce obtained by such means.

Baron Liebig’s former views of the means by which our cereal crops were to be increased were, however, directly opposed to those here stated. He assumed that fertility was quite independent of the ammonia conveyed to the soil; that if only the necessary mineral constituents were supplied in sufficient quantity and in available form, our cultivated plants, Gramineous as well as Leguminous, would derive sufficient ammonia from the atmosphere; that the presence of ammonia in our manures was immaterial; indeed, that the entire future prospects of agriculture depended upon our being able to dispense with ammonia in our manures, therefore with animal manures, and hence with the bulky farmyard manure, and substitute for it artificial preparations.

Baron Liebig now fully admitting the inefficacy of the wheat-manure devised by himself, attributes its failure to the condition of insolubility in which the mineral constituents were provided in it; and having formerly treated the investigations of Professor Way on the properties of soils with much ridicule, he now passes a well merited eulogium on the important experiments and discoveries of that gentleman and Mr. H. S. Thompson, and alleges, that since it has been shown that certain soluble mineral substances become sufficiently insoluble when supplied to the soil, the want of the anticipated effect of his manures is completely explained. It is obvious, however, that those discoveries afford no explanation whatever of that failure; for if insolubility were the only bar to efficiency, the same constituents supplied in the soluble form should have the effect which Liebig’s wheat manure was designed to produce. They should, in fact, enable the wheat-plant to assimilate sufficient nitrogen from the atmosphere for large crops. But the results of direct experiment recorded in this and former papers, as well as the common experience of this country show, that those soluble mineral manures which are effective enough

when available nitrogen is supplied within the soil, are entirely unavailing to yield any more than a very immaterial amount of increase in the absence of such supply.\*

Very inconsistently, however, with the supposition that want of solubility was the defect of his mineral manure, Baron Liebig now maintains that progress in agriculture depends, not as before on being able to dispense with a rotation of crops, with nitrogenous manures in general, and with farmyard manure in particular, and to substitute it by artificial preparations, but upon a proper rotation of crops, the successful growth of fodder plants, the use of farmyard manure, and the accumulation of nitrogenous food within the soil, so very important for the perfect growth of the cereals.

Whilst thus adopting the views which we have maintained in opposition to his own for so many years past, and have supported by much experimental and other evidence in the pages of this Journal, he seeks to convey the impression to his readers that we have in reality advocated directly contrary opinions—that, in fact, in insisting upon the necessity of an accumulation of available nitrogen within the soil for the increased growth of the cereals, we assume that the chief source of that accumulation should be ammonia purchased from without. In illustration of the hopelessness of improvement in agriculture under such conditions, he points out how very inadequate are the supplies of nitrogen in the form of purchased manure from without to any largely increased growth of corn; a view in which we need hardly say we fully concur.

No doubt the supply of ammonia, or nitrogen in some other form, from without, limited as it is, is a very important adjunct to that accumulated for the growth of the saleable cereal grains by means of rotation, and its associated practices. But we have

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\* Notwithstanding Baron Liebig's former ridicule of Professor Way's experiments, and his subsequent acknowledgment of the importance of his results only after it was generally admitted, and when it was found that they were essential as the basis of new views of his own, and that they served him to explain his previous error (in a manner, however, which is seen to be quite untenable), the following are the terms in which that acknowledgment is spoken of by Professor Hofmann in his capacity of International Reporter:—

“The correction of his error by Way, Liebig frankly and unhesitatingly accepted. His genius instantly appreciated the value of the English chemist's observation; and shed upon it so bright a light as may be said to have doubled its importance. Liebig, in fact, studied the new truth in all its bearings, supplied its most generally received interpretation, displayed its momentous consequences, elevated it to the rank of a law of nature, and embodied this law as one of the corner-stones of his great edifice.”

“Probably, in all Liebig's illustrious career, no incident bears higher testimony than this to the vigour and fertility of his intellect, to his undeviating candour, and to his disinterested solicitude, on all occasions, for truth and truth alone.” (Report of International Exhibition of 1862, p. 167.)

long ago expressed our conviction that if the supplies of ammonia were much increased, the available mineral constituents of our soils would in their turn become relatively deficient.

It is one thing to maintain, as we do, that under the existing conditions of agriculture in this country, the nitrogen in manures has justly a preponderating value attributed to it, and quite another to advocate as we do not, and never have done, that nitrogenous manures alone should be obtained from without. Nor is it the practice of intelligent farmers so to make use of the nitrogenous manures in the market. Those which the most nearly approach the character of purely nitrogenous manures, such as ammonia-salts and nitrate of soda, are rarely even for a single crop used alone, and never so by any farmer of moderate intelligence, unless—to say nothing of the periodical supplies of the home manures, perhaps enriched by the consumption on the farm of purchased food for stock—he applies specially phosphatic manure to some other crop in his course.

The objection that has been raised against the practice of purchasing food for stock, that that which is a gain of constituents to the purchaser is in the same degree a loss to the seller, surely in these days of growing intelligence, and of extension of commercial freedom and interchange of commodities throughout the world, hardly requires serious consideration. The producers in thickly-populated districts will reap the just reward of their folly if they dispose, without due compensation, of products which the requirements of their own markets, or of their own soils, render it desirable that they should keep at home. But, if countries thinly populated in relation to the area, and to the capabilities of the soils and climates with which they have to deal, should not supply the wants of those more densely peopled, in exchange for such commodities as they may need and their customers may be able to supply, because in so doing they would dispose of a portion of the mineral constituents annually liberated within their soils, the sooner this chemical principle of protection is understood and acted upon, and the sooner the commercial system of the world is abandoned, and we make up our minds to be satisfied with that which is produced at our own doors, the better we suppose will it be. For our own part, we are disposed to entertain some trust and confidence that the laws of supply and demand, if left unfettered by artificial restrictions, will in this, as in other matters, so regulate production as may best contribute to the wants of mankind at large.

Taking, however, the conditions of our agriculture as they really exist, and not anticipating a revolution in the sense just supposed, we are disposed to consider that the relation of the supplies of potass and other mineral constituents, to those of



phosphoric acid and nitrogen in the market and available from other sources, is such, that there is not much danger, except in isolated cases, of an excess of nitrogenous manure from without injuriously deranging that balance of constituents within the soil which it is essential to keep up, if not only full, but healthy, crops are to be produced. At present, at any rate, the produce per acre over the country at large is annually increasing rather than diminishing. The probability is, indeed, that any growing derangement in the composition of our soils will show itself in increasing tendency to abnormal growth, or disease of various kinds, rather than in gradual diminution of at the same time healthy crops. There is, however, as yet, so far as we are aware, no well-established evidence showing any clear connexion between the essential conditions of our modern system of cultivation, manuring, and cropping, on the one hand, and the prevalence of particular forms of faulty growth on the other.

Indeed, on many of our heavier soils, and even on lighter ones if purchased cattle-food be liberally employed, corn crops may be grown more frequently than is consistent with what have generally been considered the established rules of good farming, not only without injury to the soil, but with pecuniary benefit to the producer. On heavy soils barley of better quality may be obtained after wheat than after a root-crop. But when corn is taken after corn, great attention should be paid to the cleaning of the land, and manure should be liberally applied. When wheat follows another corn-crop, not less than 50 to 60 lbs. of ammonia (or its equivalent of nitrogen in some other form) should be applied per acre, and when barley or oats follow a corn-crop, from 40 to 50 lbs. The quantity of phosphate employed with the ammonia should be greater for spring than for autumn sown corn-crops. The manures should be applied at the time of sowing the seed.

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# MISCELLANEOUS COMMUNICATIONS AND NOTICES.

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## 7.—Mr. J. B. LAWES and the *Mineral Theory*.

By BARON LIEBIG.

IN the last number of the 'Journal of the Royal Agricultural Society of England,' published in 1863, there is a paper by Messrs. Lawes and Gilbert, in which old charges against me, personal and others, are revived; and as they have sent an extract from that paper to all the Universities, Agricultural Colleges, and Journals in Germany, as well as duplicates to myself, it is evident that they attach a great value to their statements, and in order to give others the means of judging them correctly, I think it advisable to answer them.

In my 'Principles of Agricultural Chemistry' (p. 90, 1855), I had called Messrs. Lawes and Gilbert's attention to the fact that their experiments included the proof that farmyard-manure (organic manure) could be entirely replaced by *mineral* manure (for sulphate of ammonia and sal ammoniac are mineral); and, therefore, so far from refuting my doctrine, they had really substantiated it. To this they replied that *ammoniacal salts belonged to the class of organic manure*; that I had always considered them as such; and that in falling back on the strictly scientific meaning of the terms *mineral* and *inorganic*, I was begging the question; was trying by a *manœuvre* or *ruse* to give a new definition to my mineral theory, or rather to substitute for it another which was not my own. Although I tried to convince them by a paper printed in the 'Journal of the Royal Agricultural Society of England' (1856), that I never had considered *ammoniacal salts* an *organic* manure, they return to their accusations now, and endeavour to support them by quoting the following passages of my works:—

"But the weight or amount of the crops is in proportion to the quantity of food of both kinds, *atmospheric* and *mineral*, which is present in the soil, or conveyed to it in the same time. By manuring with *ammoniacal salts* a soil rich in available *mineral* constituents the crops are augmented in the same way as they would have been if we had increased the proportion of *ammonia* in the air."—*Principles*, pp. 77-8 (1855).

"The *mineral* constituents act, as is shown by the produce of the unmanured land, without any artificial supply of *ammonia*.

"The *ammonia* increases the produce only if the *mineral* constituents be present in the soil in due quantity, and in an available form.

"*Ammonia* is without effect if the *mineral* constituents are wanting. Con-

sequently, the action of *ammonia* is limited to the acceleration of the action of the *mineral* constituents in a given time.”—*Principles*, pp. 86-7 (1855).

“ . . . . . the other is the action of *sulphate of ammonia* as a solvent for certain important *mineral* constituents of the soil.”—*Ib.*, p. 99 (1855).

“*Ammonia*, when used as a manure alone, and when there is a want of *mineral* constituents in the soil, is like the spirits which the labourer takes in order to increase his available labour, power, or imagination; and, like that stimulant, its action, in this case, is followed by a corresponding exhaustion.”—*Ib.*, p. 106 (1855).

“A fertile soil must contain in sufficient quantity, and in a form adapted for assimilation, all the *inorganic* materials indispensable for the growth of plants.

“A field artificially prepared for culture contains a certain amount of *these ingredients*, and also of *ammoniacal salts* and decaying vegetable matter.”—Fourth edition, p. 169.

It is scarcely necessary to multiply these citations, as the meaning of them is nearly the same.

The conclusion which is drawn by Mr. Lawes from these passages is the following:—

“These sentences will be sufficient to show whether or not Liebig is justified in now attempting to fall back, in agricultural discussions, upon the more strictly scientific meaning of the terms ‘*mineral*’ and ‘*inorganic*,’ so as to include within them ‘*ammonia*,’ ‘*ammoniacal salts*,’ ‘*atmospheric constituents*,’ &c., and thus to give a new definition to his mineral theory, or rather substitute at this date for his own theory, which has proved to be erroneous, another not his own.”

It is quite true that I have contrasted *ammonia* with *mineral* substances; but the meaning of these passages must be obvious to any candid reader of my works. I said (4th edition, p. 59)—

“No conclusion can have a better foundation than this—that it is the *ammonia of the atmosphere* which furnishes nitrogen to plants.”

In my ‘*Principles of Agricultural Chemistry*,’ from which the first passages quoted by Lawes are taken, I said:—

“All these substances (phosphoric, sulphuric, silicic, and the alcaleic, lime, magnesia, iron, &c.), are included in the term *mineral food* of plants. *Carbonic acid* and *ammonia* are the *atmospheric food* of vegetables.” (p. 24.)

In my book I had to explain the relation of the atmosphere to the soil in the growth of plants, and to distinguish the elements furnished by the air and those by the soil, and to avoid, by contrasting them, a long tedious enumeration of each of these elements, which all had been stated as *inorganic*. I divided them into two classes—*atmospheric* and *mineral*.

I must admit that some scientific education is required for a man to understand that the word *atmospheric*, designating *gaseous* compounds, like the word *salt* (for *ammoniacal salts*), in whatever connection they may be used, entirely exclude the idea of *organic*. We speak frequently of salts of organic acids (acids derived from organic compounds), but a salt itself is never called organic,

because it is exactly the opposite of organic. As to the term *mineral constituents*, I showed in the 8th chapter of my book that the *constituents of ashes are originally constituents of minerals*—thus, potash, a constituent of feldspar; phosphoric acid, a constituent of apatite, &c.—(See also chap. 9, on formation of arable soil, and chap. 12, on fallow.)

From this it will be understood why I used the word *mineral constituent* to designate the constituents of ashes, sometimes of soils, but never for ammonia.

*Ammonia* is a constituent of the atmosphere, but is *never a constituent of any mineral: it is mineral and inorganic, but not a mineral constituent.*

For a man not versed in scientific language, there is some ambiguity in the word *mineral*—at least in Germany we say *sulphate of ammonia is mineral* (in its origin), and the mineralogists say sulphate of ammonia is not a mineral (species); but this has nothing to do with Lawes and Gilbert's accusations.

Although the word *organic* does not occur in any of the sentences quoted from my works, and is never associated with ammonia, although I distinctly stated that the opposite of *mineral constituents* was *atmospheric*, they affirm that by atmospheric I understood *organic constituents*. Their mode of arguing is most simple. They take any passage out of my book, twist their own erroneous idea into it, and then assert that, by contrasting ammonia with mineral constituents, I had regarded it as an *organic* manure.

The origin of Messrs. Lawes and Gilbert's statements can scarcely be understood without referring to a definition of manure which Mr. Lawes gave in 1847, and which he is pleased to call his theory. It is the following ('Journal of the Royal Agricultural Society of England,' vol. viii. p. 240):—

"I NOW COME TO THE ACTION OF MANURES, WHICH are generally divided into two classes—*organic* and *inorganic*. ALTHOUGH THIS DISTINCTION IS BY NO MEANS SATISFACTORY, I SHALL ADOPT IT AS BEING GENERALLY UNDERSTOOD. Organic manures are those which are capable of yielding to the plant, by decomposition or otherwise, ORGANIC MATTER—carbon, hydrogen, oxygen, and nitrogen—CONSTITUENTS WHICH UNCULTIVATED PLANTS DERIVE ORIGINALLY FROM THE ATMOSPHERE. Inorganic manures are those substances which contain the mineral ingredients, of which the ash of plants is found to consist."

Before I enter on any discussion of this definition or theory, I must beg to recal the views on the food of plants, which I published in the year 1840. They are contained in the following passage:—

"The elements of nourishment of all green plants are inorganic or mineral substances.

"The plant lives on carbonic acid, ammonia, water, phosphoric acid, sul-



phuric acid, lime, magnesia, potash, iron; and many, too, require common salt."

As I did not admit the existence of organic food, my theory was called *mineral theory*. This name was correct, inasmuch as it was directly opposite to another theory, which prevailed before 1840.

According to De Saussure, Sprengel, Thaer, &c., there were two different laws of nourishment, and *two* kinds of manure, *organic* and *inorganic*.

"*Uncultivated plants*," says De Saussure, "receive their combustible elements from the air, their carbon from carbonic acid; but the products generated from this kind of food possess no value for agricultural purposes. The normal development of *cultivated plants*, on the other hand, and the amount of produce of arable fields, depends on *organic* matter in the soil, on residues of fermentation, and decay of *animal and vegetable matter*."

"Fertile soils contain a mixture of these remains, and their absorption by the roots is a powerful assistance to the food which is contributed by the air and water."

"Plants receive their nitrogen almost entirely by the absorption of the soluble organic substances."

"Mineral substances, marl, gypsum, clay, lime, favour the growth of plants, but take no part in nourishment."—(See 'Bibliothèque Universelle,' t. 3, p. 430; 'Ann. of Chemistry,' t. 42, p. 235.)

This view, it will be seen, is diametrically opposed to my theory, inasmuch as De Saussure maintained the necessity of *organic* food for cultivated plants, and I denied it altogether.

At first sight the so-called theory of Lawes, or his definition of manure, would seem exactly identical with that of De Saussure. Mr. Lawes assumes the existence of different laws for cultivated and uncultivated plants, and of two classes of manure, *organic* and *inorganic*, just as De Saussure and Sprengel maintained; Mr. Lawes does not claim this theory as his own, but states that it was generally understood, though by no means satisfactory.

There are, however, two essential differences between Mr. Lawes's so-called theory and that of De Saussure. First, that Mr. Lawes admits the existence of *inorganic food* or *manure*, consisting of the substances contained in the ashes of plants. The second, that Mr. Lawes applied the name of *organic* manure to something very different from what De Saussure meant. For the first, De Saussure knew nothing of the fact that the ashes of plants were nutritive elements; for he maintained that they (for instance, potash, lime, magnesia), were variable ingredients, changing with the geological formation and character of soils. I think no one can deny that I was the first to point out that the elements of the ashes were really food of plants, and Mr. Lawes has most certainly no claim to this essential part of my theory.

As to the second, by *organic* manure De Saussure meant

genuine organic matter. Mr. Lawes, however, has not the slightest desire to prove that the *vegetable mould* of Sprengel, or the *organic extracts* of De Saussure, are necessary ingredients of an efficient manure. On the contrary, all his experiments tend to prove that these substances, which cannot be produced in a manufactory, are not necessary. What then does Mr. Lawes mean by organic manures?

The reader will be puzzled to learn that Mr. Lawes's theory, correctly expressed, is exactly the same which I published seven years before his definition of manure:—That the action of manure depends on two classes of bodies. The combustible part of plants derive their carbon, hydrogen, nitrogen, and oxygen, from *carbonic acid*, *ammonia*, and water; the incombustible parts of plants consist of phosphoric, sulphuric acid, potash, soda, lime, magnesia, silica, iron; that “stable manure, the excrements of men and animals, do not influence vegetable life by means of their organic elements, but indirectly by means of the inorganic compounds which decomposition and slow combustion produce; in consequence, therefore, of their carbon being changed into carbonic acid and their nitrogen into ammonia. Thus organic manure, consisting of parts or remains of plants or animals, may be replaced by those inorganic compounds into which it resolves itself in the soil.”

The difference between Lawes's theory and mine is simply this—that he has *borrowed the substance of mine* and the *terms* of De Saussure's theory—that he calls ammonia, carbonic acid, and water, which I had called *atmospheric food*, *organic manures*!

There is still a question to be solved:—Were these three substances classed by Lawes as *organic manure* generally understood by that name?

Now it is perfectly certain that neither De Saussure nor Sprengel employed the term organic to denote these three substances, which they knew as inorganic. This denomination can therefore not be referred to them. There exist, moreover, no chemical works published before Lawes's definition (1847), in which they are classed as *organic food* or *organic manure*. It was consequently *not generally understood* that ammonia, water, and carbonic acid *belong to the class of organic manure*. The part of Mr. Lawes's theory which belongs to himself, is merely this erroneous nomenclature; I repeat, that the terms of his definition of manure he has taken from De Saussure, the essence of it is simply mine, but the manner in which he has tacked De Saussure's terms on to my meaning is purely his.

I cannot think that the humblest teacher of chemistry in Great Britain would be content to accept a theory from a man who shows such ignorance of the first elements of chemistry as Mr.

Lawes, and yet Mr. Lawes has the conceit to make believe that I had adopted his definition of manure seven years before he gave it, and that although *it was by no means satisfactory to himself*, it was perfectly satisfactory to a German professor of chemistry.

It is obvious that his definition of manure would be perfectly satisfactory, if *his* word *organic* were changed into my word *atmospheric*, and carbonic acid, ammonia, and water included in the term *inorganic*, to which they are universally assigned. Messrs. Lawes and Gilbert's conclusions belong to that class which goes under the name of *Fallacies of Confusion* in John Stuart Mill's 'System of Logic,' and which comprehends, "among others, all those which have their source in language, whether arising from the vagueness of our terms or from casual associations with them, in which no other causes can be assigned for the mistake committed than neglect or inability to state the question properly, and to appreciate the evidence with definiteness and precision."

If the leading idea of my work is borne in mind, as it is stated in the following passage (4th edition), 'On Manure,' p. 186:—

"A time will come when plants growing upon a field will be supplied with their appropriate manures, prepared in chemical manufactories, when a plant will receive only such substances as actually serve for its food, just as at present a few grains of quinine are given to a patient afflicted with fever instead of the ounce of wood, which he was formerly compelled to swallow in addition,"

it will be seen that all my statements and endeavours were directed with a view to oppose the ruling idea that *organic* manure was necessary to preserve the fertility of fields and to increase the crops. The prejudice in favour of their necessity had grown to be a dogma, and the progress of agriculture depended on the farmers becoming aware of their error.

My whole book may be described as an uninterrupted protest against the existence of organic food of plants, for organic matter cannot in the nature of things be produced by chemical manufactories; and if they were really necessary, chemistry could afford no assistance to agriculture.

If any one will consider the real cause of this sixteen years' controversy, he will be aware that it is a false definition of manure. If Messrs. Lawes and Gilbert had not classed ammonia and ammoniacal salts among organic manures, a dispute upon my theory would have had no excuse. There is something so degrading from a scientific point of view at the bottom of this controversy, that those who have taken part against the only scientific doctrine which agriculture possesses, will look back

with shame when a few years have elapsed ; but there is nothing humiliating to me, although much that is highly annoying, for I am not so proud as to think myself humbled when I am fulfilling the vocation to which I have devoted my life—that is, of instructing others. To suppose that in this controversy I was influenced by personal motives would simply be absurd. When I strenuously endeavoured to make the agriculturists view things rightly, it was not for their own sakes, but in order to ward off future evils and the imminent dangers which threaten society at large. Every man of intelligence must see the strongest confirmation of my teaching in all the facts produced in this dispute. Every single experiment of Messrs. Lawes and Gilbert brings new evidence in its favour, and every doubt must disappear by the creation and progress in all countries of Europe of an immense branch of industry—the fabrication of artificial manures from inorganic or mineral substances, which is now extensively employed.

Mr. Lawes's definition of manure, though false in itself, may yet have had, perhaps, a good effect in diffusing more widely these artificial manures, *which are all, without exception, mineral manures*. The prejudice in favour of organic manure was so strong that many agriculturists accepted under that name artificial manure which they would have refused under the name mineral manure, and Mr. Lawes, acting on his definition, could give, in all conscience, the assurance, that their manure for corn contained the *organic* constituent which is most efficacious in stable-dung.

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#### 8.—*Use of Green-podded Beans as Food for Stock.*

MY DEAR SIR,—In accordance with your wish, I send you the results of my experience, extending over several years, in the use of green-podded beans, passed through the chaffcutter and given to stock. Horses, cattle, cows, sheep, and pigs, all thrive upon this food. It is especially good for milch cows and for fattening bullocks ; so much so, that the latter will leave much of their cake if they get a full allowance of beans. To turn them to the best account they should be allowed to stand till they are well podded. We begin to use them about the first week in July, and continue to do so until the 20th of August, the period varying according to season.

There is a great weight of food in one acre of beans. We calculate that they pay about 7*l.* 10*s.* per acre in meat. It seems strange that so few are used in this manner, even when farmers are very short of summer-feed.

We generally give a little bran and malt-combs with the



beans, and from about the middle of August, when they become fit for harvesting, mix some straw-chaff with them to prevent the bullocks getting "blown."

J. MECHI.

August, 1864.

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9.—*On the Advantage of Inoculating Sheep for the Small-Pox.*

By JOSIAH DEACON.

ONLY lately returned to England after very many years' residence in Russia, I was both surprised and gratified on reading Professor Simond's able lecture on "Small-Pox in Sheep;" surprised that the question had not been long since decided, gratified at his masterly and conclusive treatment of the subject. I venture now to add my humble testimony, derived from twenty-five years' experience in the steppe country of Mid and South Russia, where I have had landed estates under my administration with flocks of merino sheep varying from a few thousand head to upwards of twenty thousand. On these inoculation was systematically employed with unfailing success. Although the sheep under my charge were perpetually exposed to contagion, from the existence in our immediate neighbourhood of flocks in which thousands have died from the neglect of this precaution, *I never lost an adult animal from the ordinary small-pox.*

In order to show the impossibility of avoiding contagion, I may state that the only boundary-mark between properties in the open steppe country is a deep furrow made with the plough, which is soon overgrown with grass. The shepherds are accustomed to meet on the border to chat with their neighbours. However strict the orders were not to approach a neighbour's frontier when his sheep were tainted by this disease, I have myself more than once caught the shepherds returning from, or close to the frontier when such a flock was in sight. Detection is, however, very difficult, as twenty thousand sheep would be spread over a space of some forty or fifty thousand acres, divided into many farmsteads.

I have heard of sheep which had been inoculated having caught the infection, but have frequently traced the cause to imperfect inoculation, which was not unfrequent so long as the operator merely passed an impregnated thread through the ear of the animal; but, as soon as the plan of making the puncture under and on the fleshy part of the tail became general, such failures were less common. I was as particular in insisting on the careful inoculation of our lambs as on the vaccination of the children of the peasants. Our losses of *lambs* from inoculation

were so trifling that we never kept a separate account ; they were merged in the general total of yearly losses.

The only precaution considered to be necessary was not to inoculate during very hot or cold weather ; the latter, in particular, proved fatal by preventing the free formation of the pustules and driving the disease inwards. Those who have the general charge of large flocks in Russia are mostly Germans who have some knowledge of the veterinary art, and I never yet met with one of them (I have had many under my orders) who doubted for one moment the efficacy of inoculation ; on the contrary, it is considered by them to be one of their most important duties to perform that operation with success. The German sheep-inspector, who is always well paid and is intelligent, would as soon think of being *without his pipe as without his inoculating needle !*

I shall be most happy to give any further information on this head to any one requiring it ; my address will be with the worthy Secretary of the Society.

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10.—*On Subsoiling Pastures, with a description of a new Implement.* By H. WOOD.

As the breaking-up of meadow-land is prohibited by most farm-leases under a heavy penalty, my attention has long been directed towards the best means of improving it. I venture to lay before the readers of the Society's Journal a brief statement of the results of my experiments during the last 20 years.

The roots of meadow-grass require nourishment as much as those of garden or field plants under spade or arable cultivation. I have known them sometimes to penetrate to the depth of 18 inches, finding their way into the holes of rabbit-burrows ; at other times they have become so interlaced and interwoven as to prevent the downward percolation of water, even after a heavy fall of rain. Puddles of water on the hide-bound surface of meadows tend to rot the grass, and where open drains are constructed, the water in passing off not unfrequently carries away with it portions of manure held in solution or suspension, and thereby robs the land of nourishment. To prevent this waste of valuable fertilising constituents, I have adopted the practice of scarifying or cutting through the surface of the meadow to the depth of 12 or 13 inches ; and a passage being thus opened, through which the water can filter, every particle of manure contained in it is retained by the soil, just in the same way as an ordinary domestic filter abstracts and detains the impurities of drinking water.

The implement which I use for the purpose is a scarifier, 6 ft. across the back beam, and 3 ft. across the front. It was originally made for tines of 3 sizes, but for these I have substituted curved knife tines to be affixed to the cast-iron frame, at a distance of  $2\frac{1}{2}$  ft. or 3 ft. apart. The knives are so curved that their point is 15 inches below, and 15 inches to the right or left of the head. The weight of the implement is from 4 cwts. to 5 cwts., and as I only use it at the end of October or beginning of November, when the ground (a tenacious soil on a clay subsoil) is soft and well saturated with rain, a pair of horses can draw it with ease, and make 7 acres of good work in a day. I prefer working at a depth of 12 or 13 inches, but this can be regulated by raising or depressing the wheels, of which there are 2 pairs so placed as to keep the implement in true position. Taking the cost of horse-hire at 8s. per diem, and wages at 2s., the cost of the operation will average about 1s. 2d. per acre.

After the heavy autumnal rainfall the surface of the meadow should be brought to a level with the roller before the scarifier is used.

*Woodhill, Ripley.*

## ABSTRACT REPORT OF AGRICULTURAL DISCUSSIONS.

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*Meeting of Weekly Council, Wednesday, February 17th.* LORD FEVERSHAM in the Chair. Mr. J. B. LAWES, of Rothamsted, Herts, introduced the subject of

### THE ACTION OF COMMON SALT AS MANURE.

He said : Salt is a substance very largely used by the agriculturists of Great Britain, and supposed to possess very valuable properties. Among its other advantages, it is said largely to increase the production of grain and straw, and to improve the quality of both. It has also the reputation of producing very great effects on certain crops of marine origin, such for example as mangold wurzel, for which it is much used, and of fixing ammonia in the soil, and conveying moisture in dry seasons. Many experiments on the advantages resulting from the use of salt have been published, but I do not propose to refer to them, because last year certain owners of salt works offered a prize for the best essay on that subject ; and when published, it will doubtless contain all that is known as to the good qualities of salt. There is great difficulty in arriving at definite conclusions with regard to the actual value of manures, and forming a correct pounds-shillings-and-pence notion of their effects in the soil. Sinclair states, as the result of experiments made in 1817, that while 45 tons of dung gave between 40 and 50 bushels of wheat per acre,  $6\frac{1}{2}$  bushels of salt gave above 70 bushels, and 45 bushels of salt gave above 90 bushels. Experiments such as these, however, cannot be accepted in the present day ; and I propose to pass over results published with regard to salt, and to confine myself to some experiments which have been carried on upon my own farm.

The field to which I am now about to refer was manured for turnips in 1839, after which there were removed from the land, barley in 1840, peas in 1841, wheat in 1842, and oats in 1843, without any manure being applied, by which the land was brought into a level and comparatively exhausted condition. In 1843 it was sown with wheat, and has been under that crop ever since. The particular experiments to which I am going to refer were conducted on plots A and B, consisting of about one-third of an acre each, and running parallel to each other down the field. With one exception these two plots have, for 20 years, received exactly the same description and amount of artificial manure each year. In 1844, 1845, and 1846 they received the same manures ; in 1847 one received rather more artificial manure than the other, and therefore I pass over those years. The Table to which I am going to refer gives the average produce of 1848, 1849, and 1850 ; for 1851, 1852, and 1853 ; and then for the last ten years. The difference



between A and B is this: they both received exactly the same amount of other artificial manure; but A, unlike B, received for three years together 3 cwts. of common salt per annum in addition to the other manures. The parallel is exact, with that exception; and if there be any difference in the produce it must be due to the salt.

**WHEAT YEAR AFTER YEAR ON THE SAME LAND.**

PLOTS A and B the same mixed MINERAL and AMMONIA MANURE each Year; and A 3 Cwts. of Common Salt, per Acre, in addition, in 1851, 1852, and 1853. Produce per Acre, &c.

Averages of Harvests.	Dressed Corn.				Total Produce, Corn & Straw (lbs.)		Corn to 100 Straw.		Offal Corn to 100 Dressed.	
	Bushels.		Weight per Bushel (lbs.)							
	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B	Plot A	Plot B
1848, 1849, and 1850 (3 years before using salt)	32 $\frac{1}{4}$	32 $\frac{1}{4}$	61·6	61·1	5988	5976	57·2	56·0	6·7	6·3
1851, 1852, and 1853 (3 years with salt)	30	30 $\frac{1}{2}$	56·9	56·7	6535	6568	42·6	41·7	12·3	11·0
1854-1863 (10 years after using salt)	40 $\frac{3}{4}$	40 $\frac{3}{4}$	58·4	58·4	7799	7811	49·6	50·4	7·4	8·3
1848-1863 (16 years)	37 $\frac{1}{4}$	37 $\frac{1}{4}$	58·7	58·7	7222	7234	49·7	49·8	8·2	8·4

Sometimes when a manure has been applied to the soil, the ensuing year happens to be favourable, and this may not be the case at another period. Therefore, to arrive at exact conclusions, we must follow the results down from year to year for a considerable length of time. It will be seen by referring to the Table that the mean produce of 1848, 1849, and 1850, the years previous to the application of salt, was 32 $\frac{1}{4}$  and 32 $\frac{1}{2}$  bushels respectively; showing that the crops of wheat were extremely alike. There was, in fact, no difference between them. Again, in 1851, 1852, and 1853, the years in which A received 3 cwts. of salt per acre per annum, and B did not, the produce of wheat per acre was exactly the same, being 30 bushels in each case. Then, in the next ten years the produce was again nearly alike. The produce of the sixteen years was in each case 37 $\frac{1}{4}$  bushels; showing that there was no trace whatever of the action of the 9 cwts. of common salt.

Some persons think that although salt may not increase the quantity of produce, it improves its quality. Let us see what was the weight of the grain per bushel. In the first three years the weight was a little higher in A than in B; in the three years 1851, 1852, and 1853, when the salt was applied, the difference was again slightly in favour of A, though not so much as it was before; and in the next ten years, the weights per bushel were almost exactly alike. In point of fact it made no difference whatever, whether we used 9 cwts. of common salt or not.

I now come to the total produce of straw and corn as shown in the second division of the Table. The total annual produce of the first three years was 5988 lbs. against 5976 lbs., a difference of a few pounds only; in the three years when salt was used the produce was as nearly

as possible the same; and in the ten years after the salt was applied, the average produce was 7799 lbs. against 7811 lbs.—again a difference of only a few pounds. In the total average produce of the whole period of sixteen years the difference was only 12 lbs., 7222 lbs. against 7234 lbs.

The next columns show the relation of corn to straw. Salt is supposed to strengthen straw and improve its quality. The figures show the proportion of corn to 100 straw. In the first period, before salt was applied, A, having 57 lbs. of corn, was rather superior to B, which had 56 lbs. In the next period we have 42·6 against 41·7, there being again a slight difference in favour of A. In the next ten years the case was reversed, and the result was in favour of the land which received no salt, the figures being 49·6 against 50. Again, in the sixteen years the comparison is 49·7 against 49·8, being a very little in favour of B. Taking the whole period, there is, practically, no difference in the proportions of corn and straw.

I must now speak of the proportion of offal corn to 100 lbs. of dressed corn as shown in the last column. In the first three years A was in this respect slightly superior to B. In the three years in which salt was applied, the reverse was the case; that is to say, the quantity of offal corn was a little larger when the salt was used. In the third year of this second period, I may remark, the balance was still greater against salt; the offal corn was then 17 on A, to 13 on B, showing that the salt had the effect of injuring instead of improving the quality. In the next ten years the result was 7·4 in A to 8·3 in B. Taking the sixteen years the results are almost identical; that is to say, we see no effect whatever from the use of salt in these careful and prolonged experiments.

Turning now to the action of salt upon another crop, I may remark that on my own farm I generally grow from 10 to 15 acres of mangold wurzel a year; and, following the common custom, I have usually applied salt to the land. My usual course has been to apply half a dressing of dung in the autumn, and half a dressing in the spring, and then the 2 cwts. of guano or some other artificial manure, and 4 cwts. of salt per acre, the salt and artificial manure being strained on the top of the dung, and ridged in, and the seed dibbled on the top. As everybody says that salt is good for mangold wurzel I have always used it; and, assuming that it did increase the crop, I was anxious to ascertain more exactly the extent of its effect. Last year I ordered one acre to be manured with 5 cwts. of salt, another with 10 cwts., and another to be left without any salt, the other manures being the same in the three cases. One thing which struck me immediately was, that the plants which had no salt grew faster than those which had it. There could be no mistake about the matter. The salt evidently appeared to check the growth of the mangold wurzel. This went on for a good many months, and at one time there was a great difference between one set of roots and the others. The crops were very carefully weighed, with the following result:—The produce per acre in roots was, without salt, 21 tons 2 cwts.; with the smaller quantity of salt it was 20 tons

10 cwts.—a difference of 12 cwts.; and where 10 cwts. of salt were applied there were only 18 tons. Again, as regards tops, where there was no salt the produce of tops was 7 tons 6 cwts., where the smaller quantity was applied it was 8 tons 5 cwts., and where the larger quantity was used it was 7 tons 8 cwts. Therefore the result was, that where the smaller quantity of salt was used there was more top and less bulb, and where the larger quantity was used both top and bulb were less. These experiments are for one year only, and therefore I do not rely much upon them. I am satisfied that this year salt has checked the growth of mangold wurzel rather than promoted it; and though this may have been because the season was a very dry one, the effect was certainly very distinct.

I have one more set of experiments to bring before you; they are not my own, but were conducted some years ago by Mr. Keary on the farm of the Earl of Leicester. Mr. Keary who was a very strong advocate for salt, and contended that it did a great deal of good, was kind enough to send me the result of some experiments which he made upon wheat in the years 1852, 1853, and 1854. His practice was, he stated, to put 6 tons of dung, 1 cwt. of nitrate of soda, and 2 cwts of salt, mixed together, per acre. In some cases his separate experiments are comparable with one another. For example, in one case he used only 1 cwt. of nitrate of soda, and in another 1 cwt. of nitrate of soda with 2 cwts. of salt. In the first year the nitrate of soda with the salt gave  $37\frac{3}{4}$  bushels, and the nitrate without the salt gave  $42\frac{1}{2}$  bushels; in the second year the nitrate of soda with the salt gave  $33\frac{3}{4}$  bushels, and the nitrate of soda without it 35 bushels; in the third year the nitrate of soda with the salt gave 47 bushels, and without it  $49\frac{1}{2}$  bushels. In the three years there was a difference in favour of the nitrate of soda without the salt of  $8\frac{1}{2}$  bushels of wheat and 6 cwts. of straw. The results of these experiments were sent to me by Mr. Keary to show the great value of salt, whereas I might cite him as a witness against salt as a manure. It may be that sufficient care was not exercised in making the experiments in the instance referred to; but be that as it may, the result is to show a loss in three years of  $8\frac{1}{2}$  bushels of corn and 6 cwts. of straw, arising from the use of 6 cwts. of salt.

Some years ago a French commission was sent to this country to inquire as to the effect of salt on corn. I never saw the Report of that commission; but the other day I wrote to Monsieur Barral (editor of the '*Journal d'Agriculture Pratique*') to make inquiries about it; and in his reply he states as follows:—

“Paris, Feb. 8th, 1864.

“The Report you mention is written by Mr. Milne Edwards. It was printed at the '*Imprimerie Nationale*,' at the expense of the French Government, in January, 1850. Mr. Milne Edwards was then trying his best to prove the possibility of restoring the old tax on salt without doing any injury whatever to agricultural interests; consequently, he declared most readily that salt is *useless as a manure*, and his opinion may be suspected of being tainted by some political prejudices. Nevertheless, I believe in the



truthfulness of that part of the Report, and am myself prepared to declare that salt is of no value *at all as a manure*, if used without any other fertilizing matter. But I am ready to alter my opinion respecting *mixtures*, as double decompositions may be produced in the womb of Mother Earth."

Thus it appears that M. Barral is of opinion that salt has no value as a manure itself, but that it may act usefully in conjunction with other manures. So far as my own experiments have proceeded, I have always used it in conjunction with other manures; but the results have not been satisfactory.

It may be asked, Why should not salt be useful when we find it existing largely in a certain class of plants? There can be no doubt that salt is to be found in a certain class of plants; but the question of the value of salt depends, I think, not so much upon what is found in the plant as upon what is sent off the farm. If salt is taken out of the land by a plant which is consumed on the farm, as is the case with mangold wurzel, it may be concluded that the salt is not exported, and that it therefore needs not to be replaced by import. As to grain, an analysis of ripe corn will show that it contains little or no salt: there is just a trace of it, and nothing more.

Animals undoubtedly contain salt. I have had a great many animals analyzed at different times, and you may assume, as a general rule, that an animal, as he stands alive, contains about 3 per cent. of mineral matter; an ox about 4 per cent., and sheep and pigs about  $2\frac{1}{2}$ . Three per cent. may be taken as an average of mineral matter, and of this about 8 per cent. is salt. Therefore an ox weighing 1000 lbs. contains about  $2\frac{1}{2}$  lbs. of salt, and a sheep or a pig weighing 1 cwt. contains about 4 ounces of salt. Hence the amount of salt carried off the farms by animals is very small indeed.

A great many experiments have been made for the purpose of ascertaining the amount of salt which falls on the land through the medium of rain. I do not wish to go into figures, but there can be no doubt that a large quantity does descend in that way upon our soil. In our climate, surrounded as we are by sea, the fall of salt in rain is decidedly larger than the amount carried off the land by salts from the farm, and consequently, so far as our fields require salt, they obtain it from that source.

Without expressing any very strong opinion on the subject, I would say that the general conclusion at which I have arrived is that salt does not act beneficially as a manure, though it has occasionally an action of some kind or other; and that if there are many well cultivated farms on which salt is used, there are also many which are kept in the highest condition without the purchase of it. I am not at all prepared to say that the former are not as well farmed, or do not produce as good crops as the latter. I cannot help thinking, that the large amount of money which is expended annually on salt as a manure throughout the British Isles is not returned in the produce. There may be some cases in which it is, but I think that, as a general rule, the outlay of money is not returned in increased production.

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In answer to the Chairman, Mr. LAWES said, as the result of experiments on the effects of salt in the feeding of cattle, he had arrived at the conclusion that, though it might be very well to give animals a taste of salt, great care should be taken not to supply it in excess.

In answer to Mr. Dent, who thought that Mr. Lawes might have used an excessive quantity of salt on his farm, and thereby retarded the growth of his crops, Mr. LAWES replied, that 4 cwt. per acre of salt had been his ordinary dressing. His object had been to grow large crops, and he assumed that salt was likely to be beneficial to mangold wurzel, but though there was plenty of plant it was possible that, in the experiments referred to, the application of salt might have been excessive.

Mr. FISHER HOBBS, having prefaced his remarks by observing that a good deal depended on the character of the climate and soil where salt is used, said:—So far as my experience goes, I may remark that in the eastern parts of England, where we have a dry climate, we find, especially in the case of marine plants, that salt is very beneficial. We also perceive that along the coast, where the air is impregnated with salt, we can grow mangold wurzel, even without farmyard-manure, better than in other situations. Not only so, but the quality of the crop is decidedly firmer, and mangold is generally admitted to contain more saccharine matter there than in parts of the interior where high farming is carried on. Therefore I think the remarks which Mr. Lawes has made to-day only show that, so far as his experiments have gone, they have not proved salt to be of very great service. I believe that salt and guano, mixed at the rate of about 3 cwt. per acre of each, form an excellent manure for both wheat and mangold wurzel. We have found in my own county that where salt has been used through a course of cropping, especially on marls and other similar lands, it has not produced the same advantages that it did previously. I myself have used it to a considerable extent at various periods of the year, and have been occasionally annoyed at having my attention called, particularly after frost, to the bad appearance of my wheat, where salt had been applied. One great benefit of salt in our dry climate is, perhaps, in its destruction of many insects in the soil, which for the last few years have been very injurious, not only to our root-crops, but also to many of our cereals. I know very well that we cannot lay down any general rule with regard to modes of cultivation or the application of manures; but I do not agree with Mr. Lawes that, on the whole, salt has been too highly valued by farmers. I think he will find, on examination, that even in a humid climate it is beneficial. In Cornwall, fishery salt, as it is termed, appears to be used almost universally for stiffening straw. In my experience I have seen fields of wheat where 3 cwt. of salt per acre had been applied, and the straw was remarkably white and very stiff, while in other cases a much smaller application has apparently produced an equally beneficial effect. On the other hand, I have known salt prove very injurious when applied to a crop of swede turnips, though when applied to mangold on the same soil it produced a good effect. We see in our gardens how beneficial salt is to asparagus, which is a marine plant. Again,

sea-weed, which of course contains a considerable proportion of salt, is now extensively used, and the more its effects are seen, the greater is the demand for it. I do not think that salt should be run down as if it were a thing of no agricultural value; for there are soils and climates where it is very beneficial when used judiciously.

The CHAIRMAN having testified to the beneficial effects of salt in arresting the ravages of the turnip-fly, asked Mr. Hobbs whether he had known salt alone to be efficacious in destroying insects?

Mr. FISHER HOBBS said he had never found any active property of that kind in salt when applied by itself, but in combination with other manuring ingredients it had so operated. A more powerful agent than salt was required to destroy the fly; and it should be applied when the plant was humid, for it would then act most beneficially upon the leaf.

Mr. DENT, M.P., would like to know whether Mr. Lawes had made any experiments with salt on grass land. A notion had generally prevailed that the application of salt to land bearing rough or coarse grass had a tendency to produce a finer kind of herbage. He had always been in the habit of applying salt for mangold wurzel. For some years he grew very good crops, but he did not believe that for the last four years any one in Yorkshire had produced a satisfactory crop; yet the crops there had, he believed, been grown very much in the same manner every year, and with the same proportion of salt. The use of salt had certainly, in Yorkshire, the effect of stopping the maggot, which was eating the leaf.

Dr. VOELCKER said, from what he had seen on a large scale in passing through different counties of England, and from his inquiries into the circumstances under which salt had been used, he had come to the conclusion that in light and sandy soils salt was often, if not generally, used with very great benefit; while on heavy soils it was attended with either no advantage whatever, or decided disadvantage. Amongst the properties of salt there was one which belonged, he believed, to all very soluble saline matters, viz., that of retarding the growth of plants when applied in quantities of above 3 cwt. per acre. Salt certainly retarded the growth of plants, and for that very reason it was, he believed, that it was of such great utility on the lighter soils. It kept the plant for a longer time vegetating and in good growing condition, and the final result was a larger produce, especially in the case of mangolds. In the eastern counties the moderate use of salt had very materially increased the root-crop, and, as he believed, in virtue of its retarding the growth of the plant. In lighter soils, when dry weather set in, roots were very apt to dwindle away, or to yield only half crops; but by applying salt in moderate quantities, provided the land were otherwise well manured, the life of the plant was prolonged, and a larger crop ultimately obtained. But the reverse of this was the case when salt was applied to heavy land. In some parts of Gloucestershire the crop was sometimes taken up before it was ripe, and the mangold was there less valued in consequence. The use of salt on stiff clay soils, such as those referred to, would further retard the ripening. The use of manures like superphosphates, which

promote early maturity, was here advisable. The question, in fact, was entirely one of maturity.

Salt was taken up in immense quantities by plants. Some time ago he made some experiments on that subject, and he was amazed at the enormous quantity which he found plants to absorb. Salt being assimilated by plants, circulated in them; and, according to their structural differences, some plants were benefited and others destroyed by it. Cabbages would take up an enormous quantity of salt. He had seen a plant with the salt taken up by the roots crystallizing on the leaves. This property of assimilation in salt was very useful for some purposes, but injurious in others. The question was, in fact, altogether one of soil. Therefore he believed they were not justified in saying, on the one hand, that salt was of no use; or on the other, that it was of very great use. It depended on the application which was made of it whether it would be useful or the reverse. Some years ago he made some experiments on grass-land with salt and with nitrate of soda. Now nitrate of soda pushed on the growth of grass, and secured a larger produce. Salt, on the other hand, checked it to such an extent, that if they used on stiffish land as much as 10 cwt. per acre, they would get less crop, even though nitrate of soda were used with it. Cattle were very fond of salt grass, naturally preferring sweet to rank herbage; and if cattle, especially when out of condition, were placed in fields where there were large deposits of ammoniacal manure, salt would be of great advantage in checking rank vegetation and sweetening the herbage. But, then, while salt sweetened the herbage, it diminished the total amount of produce. He would only add, that his last year's experiments in mangold, so far as they went, tended to confirm the view taken by Mr. Lawes. By the use of various quantities of salt, beginning with 1 cwt. and going up to 9 cwt., he obtained results which did not prove that on a heavy calcareous clay salt produced a beneficial effect.

Mr. J. HOOKER (Oatlands, Walton-on-Thames), said: Having made some experiments with salt, he had put down the results, which did not at all accord with those of Mr. Lawes. His soil was a rather stiff clay resting on a sandy subsoil, on the banks of the Thames. He took the land in 1860 in a very foul condition. Ten acres he was obliged to fallow. Four acres by the side of them, and with precisely the same kind of soil, he planted with mangold wurzel, for which crop he applied 4 cwt. of salt per acre at different periods of the year. In the autumn of 1861 he sowed the plots with rough chaff wheat over the whole fourteen acres. The plant came up well, and looked remarkably well up to the time of blooming, giving the promise of a large crop; but then the crop on the ten acres which had received no salt entirely broke down. The yield was as follows: the four acres salted gave 30 bushels per acre of good quality; the ten acres which were not salted gave 20 bushels per acre of tailing quality. He selected samples of straw from each piece for analysis in order to see what was the cause of this failure, and whether salt or the want of it had anything to do with the result. On examining the ash of that grown on the salted land he found that it gave 83 per cent. of silica; whereas



the ash of some of the best straw that could be found on the land not salted only gave 78.94 per cent. of silica. Moreover, the straw of the salted land was by far the brighter of the two, and was much harder for the reapers to cut, a consequence of its containing more *silica*.

The next year he conducted a series of experiments on the same kind of land, though not the same pieces. The wheat was drilled in the autumn of 1862, and  $1\frac{1}{2}$  cwt. of salt per acre was sown broadcast, on the 12th of May, 1863. A few plots in the piece were not salted; at harvest several pieces of each were carefully weighed. The following is the mean result of this experiment:—The land salted gave a produce of 2475 lbs. of wheat per acre, and that not salted gave a produce of 2337 lbs.; showing an excess of 138 lbs. per acre on the salted land. Further, the land salted gave a produce of 3389 lbs. of straw per acre, and the land not salted a produce of 3150 lbs.; showing 239 lbs. per acre extra on the salted land. The greater weight of straw in proportion to the wheat, is accounted for by the finer quality of the straw, which containing more *mineral* matter than that grown on unsalted land, consequently weighed heavier. He agreed with Professor Voelcker that on stiff land a small quantity of salt was better than a large quantity, and that it ought to be used sparingly in each application; he would prefer manuring the root-crop with salt to its direct application to cereals.

Mr. LAWES, in replying to the various criticisms on his remarks, said, it might be supposed that his land was not favourable for an application of salt; but it should be observed that his experiments with mangold wurzel were carried on, not upon experimental land, but as part of his ordinary farm practice; the soil being a heavy loam resting on yellow clay. Mr. Keary's experiments were also part of what is termed farming practice; and, though he said that salt was a capital manure, the results which he gave tended to show the contrary. He appeared, indeed, not to have analyzed the results of his own experiments. He (Mr. Lawes) agreed with Dr. Voelcker that when salt was applied to grass-lands the herbage looked better and the cattle seemed more fond of it; but he doubted, nevertheless, whether the grass contained the best meat-producing qualities, nor, indeed, did he think that salt ultimately increased the amount of produce. He also concurred in the Dr.'s opinion that salt checked the growth of plants; but whether that was an advantage to the farmer was another question. Did they wish their crops to be stopped at particular stages of growth? They all knew that in some years crops were too ripe in autumn, and at others not ripe enough. That was a matter which depended on the seasons. One year there was a hot summer, ripening the crops too early, the next year perhaps the case was reversed; and a manure like salt would perhaps be beneficial at one period and not at another. As regarded cattle, they knew that cows fed much on mangold wurzel were apt to scour. What they ate operated on them like a dose of salts. As agriculturists, they did not want to accumulate salt in mangold wurzel; what they needed was good feeding qualities, and the question of the value of salt and other manures depended on their



influence on the feeding properties of crops. In conclusion, he did not deny that salt might act beneficially if used judiciously on lands which were suitable to it; but when applied extensively and without great care and discrimination the crop would not, in his opinion, pay for the outlay.

MR. FISHER HOBBS, in opposition to the remark that the scour in cattle arose in a great degree from the salt present in mangold wurzel, said, that when sheep had too much vegetable matter, and showed symptoms of scour, almost the first thing the shepherd did was to give them a handful of salt, and in nine cases out of ten it proved a corrective.

MR. LAWES observed that what he had referred to was an accumulation of salts in mangold, which gave them a purgative character.

MR. FISHER HOBBS suggested whether mangold wurzel, being a marine plant, might not on that account take up more salt beneficially than was done by swedes and common turnips. He had himself observed that when salt had been used to a considerable extent for the mangold wurzel plant, it produced no injurious effect, whereas the swede died off with the same amount of salt.

MR. LAWES said he had, in fact, never grown mangold wurzel without salt; but, this year, having occasion to make experiments in relation to this question he found, to his surprise, that his crop seemed much better without salt than with it. He had been as steady a user of salt as any one, and, if questioned on the subject, he should probably have said that mangold, being a marine plant, required salt; but, after his recent experience, he should look a little more carefully to his consumption of salt another year.

MR. R. BARKER moved a vote of thanks to Mr. Lawes, and the Chairman, before putting it, said he believed that agriculturists would gladly avail themselves of any information to be derived from the practical experience of trustworthy persons who engaged in such investigation.

MR. LAWES having returned thanks, the proceedings terminated.

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*Meeting of Weekly Council, Wednesday, March 16th.* MR. RAYMOND BARKER in the Chair. Lecture by MR. ALFRED HUGHES, of Thorness, Isle of Wight, on

#### THE MANAGEMENT OF CLAY LANDS FOR SHEEP-FEEDING.

MR. HUGHES, in recommending his "scheme" or system of management, commenced with the remark that he had had two years' satisfactory experience of it on a very stiff clay farm, near Cowes, in the Isle of Wight—on land not adapted to the four-course shift, nor kind to barley; which, though it will grow valuable roots, defies the tenant to turn them to any profitable use. The farmer of such a soil, he continued, is deprived of two important sources of income: a good yield of useful malting barley, and the production on the land itself of a large quantity of mutton. He then proceeded as follows:—

The system of management which is set forth in this Paper is in-

tended only for such land as that described; and those whose lot is cast on a kinder soil, not subject to these conditions, will probably find nothing in this scheme that will assist them in their business. My object has been to discover a course of cropping adapted to this soil, to relieve it to some extent of the heavy burdens and innumerable difficulties which beset its tillage, and to find the means of profitably consuming the greater part of the root-crops on the land. The difficulties attending the management of clay-land are too well known to all engaged in it to need minute description. We have all seen the long rugged tracks of the cart-wheels in our turnip-fields, and the corresponding yellow scars in our barley crop, in the month of June, as the result of carting off our roots to the ungrateful bullock at home. We have also seen the thin barley and thinner seeds, where stood the puddled fold and unhappy sheep, afterwards the battle-field of Clod and Crosskill. Where spring corn is to follow the root-crop on land like this, and in a climate like ours, these things must happen; but what worse preparation can there be for our most valuable, most sensitive, and most delicate plant, barley? Then, again, on taking wheat after clover on such land, when there has been rain enough to admit of its being ploughed, the land comes up so tough and stubborn that the wheat can only be put in by force, and buried or rather hidden, in its water-tight drain, by a vast amount of horse-labour and wear and tear; whilst if the season be unfavourable, the wheat is not got into the land till winter is come. Now, though wheat likes a firm bottom, the seed of wheat, like all other seeds, does not like to be wedged up in a water-tight bed, smeared over with the harrow. Wheat likes an early start, and its produce is, *ceteris paribus*, very much in proportion to the progress it makes in the first quarter of its growth. If our soil, therefore, is naturally tough and binding, we must adopt such a mode of preparation as will afford as kindly a seed-bed as possible. Our seed must fall into soil in a condition favourable to a rapid development of root and stem. Again, with regard to our most valuable heavy-land roots, mangold, if they are grown after wheat, even with the most active autumn tillage, the time of preparation is so short that we do not get either the weight or the quality of root which the same land is capable of producing when exposed to the influence of a midsummer sun.

The system of cultivation which is set forth in the diagram (see pp. 524 and 525), meets these drawbacks to our success, and by affording seasonable and ample time for the profitable consumption of a very large amount of green crop on the land by sheep, enables the heavy-land farmer to participate in the advantages of sheep-farming. It renders the farm self-fertilizing, the haulage of the root-crop home is avoided, and by growing for the most part roots that will store on the land, and taking no corn-crop in the spring, ample time is afforded to consume the root-crops with advantage to sheep and land. The rotation is so arranged as to defer the repetition of each crop for seven years instead of four; and the subdivision of each course affords an opportunity of removing clover and such crops as are most sensitive on the point of repetition, to an interval of fourteen or twenty-one

years. A great advantage accruing from this arrangement, and one saving much labour, is the time allowed for the preparation of the seed-bed for each crop, especially the three with which under the four-course we have the greatest difficulty,—wheat, barley, and mangold; the latter getting a summer as well as a winter fallow, by which a weather-made surface is secured, and an immense amount of forced labour at seed-time is dispensed with.

Another collateral advantage arising out of this septennial division is the severance of the periods of sowing into smaller tasks, so that, if begun in time, none are likely to be protracted beyond due season, to the detriment of the crop itself, and the hindrance of all other work on the farm. Summer preparation for wheat renders wheat-sowing, perhaps, the lightest seed-time of the season; it affords the best opportunity for adopting thin and early sowing so well suited to a clay soil, and by being quickly out of hand it leaves the teams free to push on the autumn tillage, and, while the land is solid, to run off that portion of the root-crop destined for consumption on the old leys, and pastures, and in the homestead. The old leys remaining unbroken through the wettest portion of the winter afford a firm and healthy run of feeding-ground for the sheep when the ploughed lands will not bear them. A quantity of drawn roots should be securely stored at some convenient spot near at hand, that they may be supplied with as little labour and carting as possible to the sheep when they are driven from the fold on the turnip-land. These old leys coming into fallow for roots, and being firm and clean on the top, will bear the sheep and the carting without damage to the next crop. The sheep, when driven from these lands by the plough must be kept in hurdles, and fed with the stored roots on a dry pasture till they can take to the turnip-land again. I consider this system, and such a provision of green crop peculiarly adapted to the requirements of a flock of ewes, especially Dorsets, as both the fattening of early lambs and then that of the ewes may be accomplished on the root-crop only. I then buy in a lot of tegs to take off the summer folding of tares and rape, feeding with corn or cake, my object being to sell out in the middle of October, when they will have folded over the course intended for wheat. This year, as mutton sells well, I have kept nearly all wethers through the winter, and have fattened them with very little trouble. The plan I pursue with sheep is this: sheep bought in in September or October take the run of the stubbles, and go into fold on the land intended for winter beans or winter oats, as long as the weather remains fine. Directly it gets too wet for them there I move their night-fold to the old Italian rye-grass ley, where they find a nice fold of grass with good lodgings. When the stubble-feed gets short I send them to fold on the early white turnips; and having once commenced doing so, I would always rather carry out a little litter and bed down a fold or two than be driven off by the first rain. If wet sets in, we come off to the fold on the ley ground, and supply the sheep from the stock drawn for that purpose, until we can get on to the turnip land again. There is plenty of time, as there is no corn-crop to follow; and with a little perseverance the difficulties of the season will be overcome. The great thing, in this heavy land-  
folding

1ST YEAR. WHEAT.	WHITE WHEAT.		RED WHEAT.	
	Commence sowing in September with $1\frac{1}{2}$ pecks per acre; hoe in autumn and again in spring; put the white wheat where the winter tares and rape were fed, and change ground each rotation.			
2ND YEAR. BARLEY.	BARLEY.			
	Commence sowing first dry time after February is in, and weed at every opportunity.			
3RD YEAR. BEANS AND PEASE.	WINTER BEANS.	SPRING BEANS.		EARLY PEASE.
	Cart a good dressing of farmyard dung for this course; sow early, hoe and weed frequently.			
4TH YEAR. OATS.	BLACK TARTARIANS.	WINTER OATS.		CANADIANS.
	Break up and clean well after winter beans and put in Tartarians in March; clean well after spring beans and pease; put winter oats on the spring bean land and the Canadians on the pea-land, and change ground every rotation; dung for this crop, and hoe for seeds.			
5TH YEAR. SEEDS AND TARES.	CLEAN CLOVER.	TREFOIL. COW-GRASS. DUTCH CLOVER. ITALIAN GRASS.	SUTTON'S IMPROVED ITALIAN RYE-GRASS.	TARES REQUIRED FOR MOWING.
	Apportion the above crops according to the requirements of your business; drill all the seed when you hoe oats between the rows of corn; top dress early Italian rye-grass with 3 cwts. of guano, one half to go on in autumn, one in spring.			
6TH YEAR. MANGOLD AND TURNIPS.	SWEDES AND HARDY TURNIPS.		EARLY TURNIPS AND MANGOLD-WURZELS.	
	Put the mangolds on the tare-land and dung for them, and follow with such roots as store well; have a fair breadth of early white turnips.			
7TH YEAR. GREEN- FALLOW.	SPRING TARES, OR RAPE.		WINTER TARES, OR RAPE.	
	Put winter tares on first land cleared by sheep, breaking with plough or cultivator according to season, and follow with spring tares, rape and mustard; scuffle in the sheep-dung and plough shallow on the ridge for wheat.			



## PROBABLE SYSTEM AND COST OF TILLAGE.

	Cost of Field.	Cost per Acre.
<p>Cultivate with <i>Coleman's Cultivator</i>, using smallest size triangular share, close behind the sheep, 6 horses first time, and cross the work with 4 horses afterwards. Harrow with heavy harrows, 3 horses; roll down with pair horse roll. Labour—clearing round the field, drawing out and ploughing, 2 horses; three harrowings before drill and one after, 2 horses; light roll, striking up furrows, water furrowing, digging corners.</p> <p>Expenses taken from Farm Account Book over 9 acres . . . . .</p>	£. s. d. 10 15 0	£. s. d. 1 4 3
<p>Plough in a fair time before Christmas, 3 horses; just break down the top with one harrowing the first dry time after February sets in, 2 horses; twice cultivate with <i>Barley Cultivator</i>, 4 horses; the land being in 8 feet ridges the horses may be kept off the land. Twice harrow with heavy harrows before the drill, 4 horses; drill 14 rows on 8 feet, 3 horses; light harrow twice after drill; draw up furrows, water furrow, dig corners, women to pick and clear the land.</p> <p>Expenses taken over 20 acres . . . . .</p>	18 8 6	0 18 5
<p>WINTER BEANS. Filling, carting, and spreading 16 loads per acre raw dung; ploughing, 3 horses; twice harrow, 4 horses; once, 2 horses before drill; drill 7 rows on 8 feet with double tins, 4 horses; light harrows twice after, 2 horses; furrow plough, water furrow, dig corners. Labour—picking and clearing round field.</p> <p>Expenses taken on 8 acres . . . . .</p>	12 0 4	1 11 3
<p>SPRING BEANS AND PEASE, filling, and carting 240 loads to heap; turning, filling and carting 176 loads on the land; spreading, ploughing, 3 horses; water furrow for winter; dig corners and clear round field; <i>Spring-work</i>, twice harrow, 4 horses; once, 2 horses; use <i>Barley Cultivator</i> if necessary. Drill 7 rows with 4 horses; light harrow twice after, 2 horses; draw furrows, water-furrow, &amp;c.</p> <p>Expenses taken over 12 acres . . . . .</p>	24 17 7	2 1 6
<p>WINTER OATS. Break up <i>spring bean land</i> with Coleman, 6 horses, crossing with 4 horses, selecting such points, chisels or shares as will enter the ground well; twice harrow with 2 horses; roll with pair horse-roll; light harrow; horse rake, picking and burning, filling, carting, and spreading 14 loads per acre raw farmyard dung; plough, 3 horses; twice harrow, 3 horses; drill 12 rows on 8 feet; light harrow twice after; strike furrows, water furrows, cut and clear round field.</p> <p>Expenses taken over 8 acres . . . . .</p>	15 10 2	1 18 9
<p>SPRING OATS. Clean the <i>winter bean and pea-land</i> in the Autumn, but don't break it. Tillage the same as for <i>spring beans</i>.</p> <p>Expenses taken on 8 acres . . . . .</p>	12 2 9	1 17 10
<p>Reserve land for sufficient <i>tares</i> for cart horses, colts and cows; take also what is required to provide <i>spring feed</i> for ewes and lambs, and sow with Sutton's improved <i>Italian rye-grass</i>; this will come to the scythe or feed when the <i>tares</i> are done. Sow what <i>clean clover</i> is expedient, and seed the rest down with a <i>mixture</i> adapted to the soil, and that will make a good firm bottom, this will be the last to break up for roots. 2 horses roll, mix seeds for drill; drill, 2 horses; roll 1.</p> <p>Expenses taken on 10 acres . . . . .</p>	Tare land preparation on 8 acres. 7 14 10	0 19 4½ 1 8 0 0 2 9½
<p>MANGOLDS. 4 acres mucked before harvest, 12 loads per acre, long muck; filling, carting, and spreading; mow and cut round field, plough the whole, 3 horses; water-furrow for winter. Filling and carting 80 loads to heap for remaining 4 acres; turning ditto back in a dry time, 3 horses; harrow once heavy drags, 4 horses; cultivate with 4 horses, <i>Barley Cultivator</i>. Filling, carting, and spreading on 4 acres; roll down, draw out and plough, 2 horses; roll, 2 horses; harrow, 2 horses; burning and carting earth; mixing, filling, and carting manure to field, 18 loads; drill, 3 horses; roll, 1 horse.</p> <p>Expenses taken on 8 acres . . . . .</p>	20 7 6	2 10 11
<p>CLOVER LAND FOR SWEDES AND HARDY TURNIPS. Plough as deep as soil will permit, 3 horses, in March or April; harrow twice directly the land will work, and again in a fortnight; or use <i>barley cultivator</i> if the land will work without raising the sod, 3 horses; put manure on with distributor, and harrow in same time, before the drill, 2 horses, and 2 horses; burning ashes, sifting and mixing manure, carting ashes home and manure to the field; drill, 3 horses; roll, 1 horse.</p> <p>Expenses taken on 8 acres . . . . .</p>	8 15 9	1 2 0
<p>RYE-GRASS FOR TURNIPS. Plough first time in January or February, 3 horses; water furrow; turn back in March, 3 horses; harrow twice with heavy drags weighted, 4 horses, when the land will work. Cultivate across twice with Coleman's clod crush, 3 horses; harrow, 2 horses; roll, 1 horse; women picking docks and grass; plough for crop, 2 horses; burning earth, sifting, and carting earth home, 1 horse; mixing, cart to field, preparing land for the drill, distribute manure, 2 horses; harrow, 2 horses; roll, 1 horse; drill, 3 horses; light roll, 1 horse.</p> <p>Expenses taken on 8 acres . . . . .</p>	16 0 4	2 0 0½

folding is to persevere, but not to persist; recollecting that all the labour and attention expended on sheep is well bestowed, not only on them but in saving the hauling of roots home, and of dung to the field.

I will now take the crops year by year.

I commence with *wheat*; but my mode of preparation for it will be best stated in connection with the preceding crop.

Supposing the wheat-stubble to be there, I find that, on a strictly clay farm, I can grow on an average of seasons a much better quality, and a much larger quantity of BARLEY upon a wheat-stubble than after turnips or any root-crop; for whereas the difficulty of managing the root-crop, is such as to stand in the way of getting such land into proper condition for barley, after wheat ample time is afforded for the purpose. The way we proceed in preparing for the barley-crop is this:—In harvesting the wheat we leave a 6-inch stubble on the land; that is, we cut as high as we can with the scythe consistently with cutting the corn off clean. I find it advantageous not to turn in the wheat-stubble much before Christmas; the land being a sounder and healthier seed-bed for barley when not longer exposed to the wet.\* We select a fair time for ploughing with three horses. We then break down the top by harrowing once, with two horses, in the first dry time in February. We twice cultivate with a barley-cultivator, a light implement that I have had constructed specially for this purpose, and this, which we use instead of the harrow, lifts the soil completely up, as deep as it has been ploughed. This requires four horses, as my land being in 8-foot ridges, the cultivators, drills, harrows, and other implements, are made to take a whole ridge. Having gone once over the ridge, we repeat the operation; but in the second instance we drive the cultivator in the opposite direction. This is the finest preparation I have yet known for barley upon clay land. The land being in 8-foot ridges the horses may be kept off it.† Taking the entire expense of horse and hand labour from beginning to end of the process, I find the total cost of preparing twenty acres of land for barley to be 18*l.* 8*s.* 6*d.*, or 18*s.* 5*d.* the acre; but I set a low price on my horse-labour, having some salt marshes close at hand, and a good run for the horses, which cheapens their keep considerably.

After barley come BEANS AND PEAS. For this crop we cart a good dressing of farmyard-dung, sow early, and hoe and weed frequently. I divide this course into three different classes—(1) winter beans, (2) spring beans, and (3) an early description of peas.†

The next course, that is the fourth year, is *oats following upon beans and peas*: and with the oats we lay down the land to clover. Some gentlemen may have thought that this work was overlooked, and wondered how I should bring it in; but I find that I have grown much

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\* I account for the difference in this way:—On tenacious soils, like mine, the land cracks prodigiously in the summer, and these cracks, if undisturbed, form watercourses and means of escape for the heavy autumnal rainfall: whereas by autumn tillage all these channels are stopped. At all events, I find that in practice the land broken up in autumn, comes up more sodden under spring cultivation than that which was broken up after Christmas.

† For details and cost of cultivation, see diagram.

better seeds after a good standing crop of oats upon my land than I ever did after barley and folding, and I can get my seeds up with greater regularity and certainty; therefore I seed down the oat-crop for clover.

The OAT-CROP again I divide into three parts, first, winter oats, of which I get in some in the autumn in order to make sure of some forward corn; then black Tartarian oats, a hardy productive kind for the spring; and lastly, some Canadian oats. I sow Tartarians after winter beans in March, put winter oats on the spring bean-land, and the Canadians on the pea-land, and change the ground every rotation. I dung for this crop and hoe for seeds.\* When preparing for *spring oats*, after winter beans and peas, we clean, but *do not break*, the land in autumn, finding that it is advantageous to let the land lie for some time.

We have now got through the four crops of corn, which follow one after the other, thus:—Wheat, barley, beans or peas, and oats. I come next to the *first green crop or fifth year*, wherein we have clean clover, trefoil, cow-grass, Dutch clover, Italian grass, improved Italian rye-grass, besides the tares required for mowing. Apportion those crops according to your requirements, drill all the seed when you hoe oats between the rows of corn, and top-dress early Italian rye-grass with 3 cwt. of guano, one-half to go on in autumn and one-half in spring. Reserve land for tares sufficient to supply nag-horses, cart-horses, colts, and cows, and also to provide spring-feed for the ewes and lambs. Sutton's improved Italian rye-grass—the most reliable plant I have come across for many years—will come to the scythe or be ready for feeding when the tares are done. Sow what clean clover is expedient, and seed the rest down with a *mixture* adapted to your soil, so as to make a good sound bottom; this will be the last to break up for roots.\* This is the land on which, as I have said before, our sheep will stand during the wettest part of the winter, our old clover-leys remaining unbroken till quite the spring of the year, and giving a firm run for the sheep when no other part of the farm would bear them. The mixture I sow is composed of trefoil, cow-grass, Dutch clover, and Italian rye-grass; my mode of sowing is this: I horse-hoe with Garrett's implement, and drill the small seeds between the rows of corn at the same time that the hoe breaks the surface; thus the weeds die and the seeds begin to live at the same time.

I come now to the sixth course—*roots following seeds*. I reserve the land which was in tares for mangold; the reason being that cutting these early tares for the use of horses, we at once cart on long manure, which is ploughed in immediately with three horses at a great depth, so that the land is often under a summer fallow in May. I follow the mangold with such roots as store well, and have a fair breadth of early white turnips.

I come now to the second division of the seeded or clover land, that is, the *land intended for swedes and hardy turnips*. I plough as

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\* For details and cost of cultivation, see diagram.



deep as the soil will admit of in March or April. At first I began by ploughing the land up earlier; but I found that by waiting until the water was going down in the spring of the year, my land came quicker for the root-crop than if I had turned it sooner, and it had received all the wet of the winter. I also found it healthier; and when pressed for a dry spot for sheep, I had these good, sound, healthy clover-leys to go to.\* I think you would be surprised to see the clover-lands that I have just turned in for roots. Notwithstanding all the wet weather we have had this year, they ploughed remarkably well, and I am much nearer a turnip-crop there than I ever was by repeated ploughings during the ten years that I farmed clays in Suffolk.

I come now to the third division of the ley ground in the preparation for roots; that is, the *rye-grass land*, which was laid down for the ewes and lambs in the spring of the year. We plough up the rye-grass ley the first time in January or February, giving it more tillage than the rest, because Italian rye-grass gets tough and bunchy, and wants more dealing with than clean clover land.\*

We are now arrived at the next course—the seventh year, or *green fallow*. We generally preserve a portion of mangold on the land: I have now 15 or 20 acres all stored on the land, for consumption upon it by the sheep. But we always run off sufficient to secure us in the long spring, that we may have food to give the sheep and cattle elsewhere. After the mangold has been removed, we plough as early as possible with three horses, and put in winter tares, if any more are likely to be required; but sometimes the land on my farm is so exceedingly stiff, that I let it remain through the winter without a crop, and then seed it down with winter tares in good time in the spring, and so fold it off in summer and prepare the land for wheat. The whole of the root course is now ploughed, and got in order for a summer green-crop as speedily as possible. As the sheep clear away the roots and fold off the ground, so we plough the land up in preparation for another green crop; and the most profitable one I have yet met with is rape, which we put in as the land is broken up with the same manure that we use for turnips. The successive sowings provide a succession of food for the sheep; the new green-crop is at once put into the mangold land for summer consumption, and the turnip-land comes afterwards. My earliest sowing of rape is in April, and I put plenty of manure; cultivate with barley-cultivator, four horses; harrow, two horses; mixing and distributing manure, two horses; drill, two horses; light roll, one horse. The expense of tillage in preparing for the summer green fallow after roots on eight acres is 6*l.* 12*s.* 4*d.*, or 16*s.* 6½*d.* per acre.

I have now to direct your attention to the *folding of turnips and the preparations for the same summer crop*. Break with Coleman as soon as the land is dry enough; let it lie and get thoroughly dry; then, after the first good rain, harrow well, and raise plenty of mould, and get the rape and mustard in to follow for the sheep. Cultivate with six

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\* For details and cost of cultivation, see diagram.



horses; harrow, three horses; roll, two horses; harrow, two horses; mix manure and distribute, two horses; drill, two horses; roll, one horse. Expenses, taken on eight acres, 4*l.* 11*s.* 3*d.*, or 11*s.* 5*d.* an acre. This comes to rather less than the mangold land, because it is done later in the spring, when the land works easier.

The next point I have to deal with is *the bare winter fallow*, where a piece of land is not cropped at all. We plough that with three horses at a convenient season in winter, and put in winter tares in February: cultivating as for rape on mangold land. The expense, taken on eight acres, is 7*l.* 13*s.*, or 19*s.* 1½*d.* per acre.

The process of feeding off the summer green crop is of course the *preparation for the first year's crop of wheat*. The expenses, as shown in the diagram, amount only to 1*l.* 4*s.* 3*d.* per acre—a very important reduction on the usual cost of preparing for the wheat-crop on heavy land farms.

These, then, are all the details of my system of management. Its principal feature is—that between two succeeding crops, whether corn or otherwise, ample time is allowed to prepare a good weather-made surface for the seed which is next to come. Another important feature is that the root-crop we have raised at so much expense may be consumed at the precise time when it is most profitable and convenient to do so. Under the old system you know the spring-corn is hanging over head, which must be got in by a certain time and consequently the roots must be got rid of—as they say in Suffolk, the roots must either be “puddled in” or “muddled off” the land; but by this course of cropping I avoid that difficulty, and I give myself sufficient time to consume a large amount of green crop upon the land when it will bear sheep.

In reply to Lord Berners,

Mr. HUGHES said he drilled as much rape as he did of swede turnips—about two pints per acre, with about one pint of mustard. He commenced drilling it in April, went on until June, and mixed it all the time. He looked upon mustard as useful, but rape was the plant; indeed, that which he grew after turnips last year, upon the stiffest clay he had ever seen, was of such enormous bulk that this year he had taken his turnip platform into the field, put on the chaff-cutter, and cut up the whole crop for the sheep. The wages he paid were 10*s.*, 11*s.*, and 12*s.* a week to the labourer, and 8*d.* a day to the women; but they were about to be raised. The horses cost only 1*s.* 6*d.* a day; but he had the advantage of having a considerable run for them in the summer, when he got rid of them for a long time. He hired his land five years ago, at 7*s.* an acre, and the rent was an increasing one. He drilled his oats in rows of 8 feet, and he hoed once before putting in the seeds.

In reply to Mr. Thompson and others,

Mr. HUGHES said, that, in growing wheat after two successive green crops had been fed off, the wheat was not too heavy, if only planted early and thin. He used 1½ peck of wheat and 3 bushels of oats to the acre. The number of sheep he kept varied with the state of the markets. Until this year he had generally kept Dorset ewes, which

he fattened with their lambs; but as there was a prospect of mutton being dear, he had this year fattened wethers instead, so that he was saved trouble with ewes and lambs, and enabled to feed rather more wethers than ewes, because provision had to be made for the wants of the lambs. He had a good deal of old pasture, but the sheep never saw it till after the clover-lands were ploughed in spring. In a wet spring the sheep were driven to a dry pasture till they could go to the turnip-lands again. He kept a great many colts and pigs, but no bullocks at all.

Mr. J. HOWARD asked what Mr. Hughes did with his horses at Michaelmas, and during the autumn months, seeing that he left the clover-ley until spring, and the fallows untouched until January, or later in the year?

Mr. HUGHES said that he put in winter beans and winter oats, cleaned and tilled the bean-land, and carted off all that was required of the mangold, and some early turnips for the ewes and lambs in the spring. He did not use so many horses under this system as he formerly did; and he had had no idle horses in autumn since he had farmed clay-land.

Mr. HOWARD was sure that he had not in the spring, when the great bulk of his work appeared to be done. He agreed with Mr. Hughes as to growing tares instead of roots on strong land. For many years that had been the custom in Bedfordshire, and a better crop of wheat was got after it. His experience of autumn cultivation, however, was, that the sooner after harvest clay-lands were broken up the better; and he suggested that if Mr. Hughes got a steam-cultivator on his clay-land he would have some advantage in breaking-up in the autumn, and would not find the land so tenacious after treating it in that manner; nor, indeed, would it be necessary to put it up in 8-feet bands or ridges, as clay lands when broken up at a great depth and laid flat require no furrow.

Mr. HUGHES would be only too glad to find that the steam-cultivator could be used with advantage on such ground as the Hampshire hills, with their stiff clay soil. He admitted that he got out of the 8-feet ridge whenever he could; but his chief reason for maintaining it upon his farm was that his land was so dependent on the seasons that by this means alone he was often enabled to snatch an opportunity to pop on his harrows and drills, and put in his corn, the horses walking in the furrows, whereas, if they were walking on the flat surface they would make a furrow with their feet.

Mr. HOWARD thought Mr. Hughes entirely wrong in the conclusion that steam was not adapted to hilly land. On the contrary, the more hilly a country was the greater would be the advantage of steam, for the simple reason that such land was more difficult to cultivate with horses, and there was a larger margin of profit on the employment of steam. Where a horse could go, steam could go there better.

Mr. THOMPSON said that he had some particularly heavy clay-soil, and he found that the great thing was to have it as dry as possible: it then became mellow, and more easily worked with less labour. He thought that by ploughing in autumn they would generally secure a

dry seedbed; whereas, if they left the land unemployed until the spring, there was great uncertainty about it; in the North of England particularly they could not get it ploughed early enough to put in the seed.

LORD BERNERS, in proposing a vote of thanks to Mr. Hughes, said he could go a great deal further even than Mr. Howard in recommending the use of the steam-cultivator and steam-digger. He had had many years' experience of their use; and scientific gentlemen, when they visited his farm, said, "If you can work a plough up and down these hills on this strong tenacious clay, you can do it anywhere." By cultivating the old clover-leys and everything he could get at in the autumn, the land was now in the most perfect state possible. The greater part of it only required to be further harrowed down once, and to have the cultivator once passed through it, to fit it for all business purposes. Some years ago he adopted the Norfolk system known as the ten-furrow work, and had all his implements made to fit; so that in ploughing, drilling, and other operations, the horses trod only in the furrows, and from seed-time to harvest never trampled on the land. He now found from experience that by deep draining and deep cultivation, especially autumnal cultivation, he had no longer the slightest occasion for ten-furrow work. And there was this further advantage, that, whilst formerly upon his strong lands he could not work the reaper, he could now cut all his corn, beans, and everything with that implement in the most effective manner. To show the benefit of steam-ploughing more particularly, he might mention that just before last harvest he took a farm into his own hands, 80 acres of which were in the worst possible state, overrun with twitch and almost every thing that was bad. Having no horses to spare, he sent his steam-cultivator on to the land, and before Michaelmas arrived he had every acre quite clean, some of it having been cultivated three and four times over; the application of the rotary-harrows of Ashby of Stamford helped materially in getting the land into perfect condition. Now, if he had had *any* number of horses, it would have been impossible for them to have broken up the land, for it was as hard as the road.

The vote of thanks having been put, Mr. HUGHES in reply said he was by no means opposed to steam cultivation, but looked forward hopefully to a time when he should be able to use it economically, even on his heavy clay farm.

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*Weekly Meeting of Council, May 11, 1864.* Mr. RAYMOND BARKER in the Chair. Lecture by Dr. AUGUSTUS VOELCKER.

#### THE ATMOSPHERIC NUTRITION OF PLANTS.

Dr. VOELCKER said:—Theoretical inquiries, as to the nutrition of plants, may at first sight appear of very little practical interest, but it will be found on reflection that questions of vital importance to the farmer depend very much on their accurate solution.

Within the last year or two the controversy as to humus has been



revived under the new name of the vegetable mould theory; and serious apprehensions are entertained by many intelligent, educated people that, by degrees, we may relapse into a condition wherein it will be difficult to grow remunerative crops on the soils of England. Such apprehensions could not possibly have been entertained had correct views existed as to the way in which plants take up their food. The old humus theory has been successfully annihilated; indeed, after Liebig's forcible writings in exposing its fallacy, it is impossible for it to be maintained. Yet up to this day, readers of respectable journals are addressed in lengthy papers, on the so-called vegetable mould theory, which are anything but satisfactory to those acquainted with the recent progress of scientific research in relation to the process of vegetable nutrition.

In dealing with the subject of the atmospheric nutrition of plants very little can be said that is original, or of very recent date; for within the last five or six years no very striking discoveries bearing upon the subject have been made. Our knowledge, however, in the absence of any material additions, has become more definite and positive, so that we can speak with greater certainty on matters of which we had formerly but indistinct ideas.

The atmosphere is a mechanical mixture, chiefly of two gases; oxygen constituting about 21 parts in round numbers, and nitrogen 79. Mixed with these two gases are carbonic acid, ammonia, and nitric acid in certain small proportions; water is also invariably present in the shape of vapour. It is interesting to notice that nitrogen, the most conspicuous constituent of the atmosphere, does not take any direct part in the nutrition of plants, but it is precisely those small quantities of matters for a long time overlooked—viz., ammonia and nitric acid, that are most active and influential in the process; for notwithstanding some experiments recently made in France by M. Ville, it has been decisively shown by M. Boussingault, in France, and Messrs. Lawes and Gilbert, in England, that nitrogen, as an element of the atmosphere, is not assimilated. Oxygen, the other great constituent of the air, has an influence rather indirect than immediate in the nutrition of plants. Plants, through the medium of their leaves, restore oxygen to the atmosphere, and thereby keep up the balance which it is so necessary to maintain, but which is continually disturbed by the removal of the oxygen by animals for the support of respiration. We have abundant proof that it is chiefly the carbonic acid of the atmosphere that supplies the carbon of plants, or, in other words, the great bulk of all vegetation. It is calculated, indeed, that at least three-fourths of the dry substance of plants is derived from the carbonic acid of the atmosphere. During the daytime, the absorption takes place continuously; and, no sooner have the leaves absorbed carbonic acid than they set about the work of destroying its form, assimilating the carbon, manufacturing it into starch, gum, sugar, and other combinations found in all vegetable productions, and at the same time throwing off the oxygen so as to restore the balance.

It is by some supposed that the decomposition of carbonic acid



takes place only in direct sun light; this, however, is a mistake, for the reflected rays and diffused light are equally as capable as direct light of producing this effect. As carbonic acid is the chief source whence plants derive their carbon, the question naturally arises:—Is there sufficient in the atmosphere to meet all the requirements not only of wild but cultivated plants? At first sight this atmospheric supply would appear to be anything but sufficient for the purpose, for according to De Saussure's accurate and precise determinations of the amount, there are only about four parts of carbonic acid in every 10,000 parts of air. These determinations have been confirmed by many other observers, and it is therefore not far wrong to say that every 10,000 parts of air contain from 4 to 5 parts of carbonic acid. This is a small relative proportion, doubtless; but when we consider the enormous volume of the atmosphere, the perfection and beauty of the apparatus which plants are provided with for absorbing the carbonic acid diffused around, and constantly wafted in all directions towards their leaves—when we further consider that in some instances plants arrive at maturity which have had no other source from whence to derive their carbon, we are forced to conclude that the atmospheric supply is sufficient for most plants. This idea does not preclude another, that carbonaceous matters in the soil are most essential for certain purposes; but as a rule it is the carbonic acid of the air, and not the carbonaceous matters in the soil, which supplies carbon to plants.

Observations on the wants of plants have been somewhat enlarged of late years, and I believe I am not wrong in stating that whilst some plants entirely rely upon the carbon they find in the atmosphere, others are greatly benefited by carbonaceous matters, sometimes termed humus, which it is desirable should be present, in the soil. I believe that cereal crops are not dependent in any great measure upon any carbonaceous or organic matters in the soil; whilst root crops, turnips, mangolds, and others are materially benefited by the carbon present in the humus. Whether it is, however, in the shape of prepared organic matter that the humus acts usefully as a source of carbon to roots, or whether it is because the humus in the soil is continually undergoing a change, and producing carbonic acid in the very soil which grew the roots, I leave for the present undecided. Indeed, we have no very distinct experiments, nor are they easily instituted, to show that organic matters as such are taken up by plants; but this is certainly known as an important fact, that the air in the soil itself contains a very much larger proportion of carbonic acid than the atmosphere resting upon it.

Some years ago M. Boussingault made some very careful experiments upon the amount of carbonic acid which occurred in soils, and he found that whilst the atmosphere resting upon the soil only gave 4 to 5 in every 10,000 parts, the air in sandy soil recently manured, contained 217 parts of carbonic acid in every 10,000 parts. Shortly after rain the air from the same soil was again analyzed, and was found to contain as much as 974 parts of carbonic acid; evidently showing that the wetting of organic matter, and the rapid decomposi-

tion which had taken place in it through contact with the porous earth, had led to the destruction of the humus and the formation of large quantities of carbonic acid. This throws some light upon the very startling growths sometimes noticed, especially in the case of root-crops. The rapid start of young turnips after a good shower of rain, on well-dunged land, arises from the rapid production of carbonic acid in the soil; but we look in vain for this result in soils not properly cultivated.

Plants, and root crops especially, not only take up carbon through the medium of their leaves, but apparently also in the shape of carbonic acid in very large quantities through the medium of their roots; it is especially useful to furnish root crops at an early stage of their growth with matters that supply carbon in the shape of carbonic acid. Boussingault shows that whilst in calcareous soil there are in 10,000 parts of air only 87 of carbonic acid, and in heavy clay soil only 66, there are in pasture-soils as many as 179 parts of carbonic acid to every 10,000 parts of air. Thus it will be seen that in all these instances, the quantity of carbonic acid in the soil is very much larger than the quantity resting immediately above it.

In the next place I have to direct attention to atmospheric ammonia, which is, perhaps, the most important constituent of the atmosphere. For a very long time this was entirely and very pardonably overlooked, since the quantity is so small that it cannot be determined with anything like precision, and it is necessary to have recourse to an examination of the rain or dew to ascertain anything like an approximation to the truth. Determinations of the amount of ammonia and nitric acid in rain-water have been made by Messrs. Lawes and Gilbert, and by Professor Way, and in France by M. Bineau, and also by M. Boussingault, who has done so much for the progress of scientific agricultural chemistry. According to M. Bineau, 1,000,000 parts of air contain only about .2 of ammonia; the amount varying in different seasons. According to these researches, the rain which falls annually upon an English acre carries upon the land about 22 lbs. of nitrogen. This quantity includes the nitrogen which occurs in rain-water in the state of ammonia, as well as that in the form of nitric acid. Twenty-two pounds upon an acre is but a small amount,\* and we have to consider the very important question whether this quan-

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\* In the course of a subsequent lecture Professor Voelcker qualified the statement here made by explaining that he quoted from Baron Liebig's 'Laws of Husbandry' when he assigned these proportions to the ammonia in rain-water. Dr. Voelcker then added, "I find that the figures do not correctly represent the average amount of ammonia which is present. I mentioned 22 lbs. as the amount of ammonia, but 14 lbs. would be nearer the mark." This correction is important in reference to the consideration whether atmospheric ammonia is sufficient to meet the requirements or wants of the plants. If it be stated to be half as much again as it actually is, that of course makes a difference in our views respecting the propriety of supplying ammonia in the shape of manure, or leaving plants to find their supply in the atmosphere." The amount of ammonia in rain-water, no doubt, varies considerably in different localities, and it is, therefore, not easy to give a fair average. On the whole, however, he thought 14 lbs. represents more nearly the average of ammonia in rain-water than 22 lbs.

tity is sufficient for the requirements of plants. M.M. Bineau and Boussingault pursued a very extensive series of experiments bearing upon this matter, and from them it followed that whilst some plants may find a sufficient quantity of nitrogen in the shape of ammonia or nitric acid in the atmosphere to enable them to grow luxuriantly, others are decidedly benefited if, in addition to the atmospheric ammonia or nitric acid, they are supplied through the medium of the soil with either ammoniacal salts or nitrates, or organic matters producing, on gradual decomposition, either nitric acid or ammonia.

It is generally admitted that cereal crops are more benefited by ammoniacal fertilizers than those commonly termed green crops. It is interesting to inquire as to the reason of this distinction. It would seem at first sight that green crops are more capable than cereals of assimilating atmospheric ammonia or nitric acid, because of the greater development of the leafy part. But it is only under certain conditions that root-crops can be thrown entirely upon atmospheric resources for their food. When plants like turnips grow rapidly, it generally happens that the soil contains a considerable quantity of organic matter, which favours the development of leaf; but when for some reason or other a deficiency of organic matter occurs, as is often the case in sandy soils, ammoniacal matters are supplied with great utility even to root crops. There are, however, other instances in which those manures are entirely wasted. How necessary it is then that we should have precise and accurate observations upon these important matters, and that we should not be satisfied with general statements not unfrequently made by men who, though eminent for scientific research, are deficient in the qualifications of mind that would entitle them to become the guides of practical men! Many theories are extremely beautiful, simple, or interesting to all who take an interest in the progress of farming, but, from want of sufficiently minute attention to details, the farmer in his application of them may be seriously misled. The sum and substance of my observations is, that whilst we know that under certain conditions which have as yet to be still more minutely examined, and for certain crops, we have a sufficient atmospheric supply of ammonia and nitric acid, there are other crops, and more especially cereals, which do not grow with sufficient rapidity to be remunerative without the addition of nitrogenous manures to the soil.

Upon the great influence of water, whether in the shape of watery vapour, dew, or direct rain, as necessary food to plants, I need not dwell, but I pass on to another effect of the atmosphere on vegetation.

The observations I have hitherto made all tend to show the *direct* influence which the atmosphere has in the nutrition of plants; but there is another part which it plays in the growth of vegetables, which, though it may be called the *indirect* one, is so great in its effect, that we may say positively that all soils which are not penetrated by air are unproductive, no matter how much food they may otherwise contain. Cases are constantly brought under my notice, of soils, sent for examination, which are characterised as unproductive, but turn out to contain an abundance of all the mineral constituents



required for the growth of plants, and require only to be thoroughly penetrated by the air in order to furnish an unlimited quantity of food. The atmosphere really exercises a most beneficial effect both on the inorganic and organic constituents of the soil. I have alluded to the large quantity of carbonic acid present in the air which exists in the interstices of the soil, but this supply cannot be produced unless the air finds its way into the soil. An excess of organic matter in the shape of decaying roots or leaves is so injurious, that where it exists in soils which are not easily penetrated by air it would be much better for it to be burnt altogether away. At first sight this may appear to involve a great waste of useful material in clay-soils; but if the beneficial effect be greater than the sacrifice, it can scarcely be called a waste; for although serious doubt has been entertained respecting the utility of burning, some soils are with so much difficulty penetrated by air that burning is the only way of destroying the organic matter, which when present in an imperfectly aerated condition is rank poison to most cultivated plants. It is certain that the destruction of sour humus, as it has been called—though in a chemical point of view all humus is acid—has been attended with most beneficial effects, and when recourse cannot be had to proper means of aëration, this destruction has been practised with very great advantage to the succeeding crop, even if, as in the case of turnips, it would be otherwise benefited by the presence of carbonaceous matters in the soil. When, however, we can effect the destruction of organic matters by the atmospheric oxygen, the practical result, I have no doubt, will be greater; for not only does the air, and more especially the atmospheric oxygen, act upon the organic matters in producing carbonic acid, but it also has an important effect upon them in producing nitrates in the soil.

The quantity of organic nitrogen in the soil is very large. Some years ago I made an experiment with the view of ascertaining how much nitrogen was present after the clover crop had been removed, and I ascertained that, taking an acre as the experimental area, it was equivalent to rather more than the amount of nitrogen present in 8 cwt. of Peruvian guano. It has been found that the clover crop is the most excellent preparation for the succeeding wheat, and it is known now as a fact, that after growing a good crop of clover a very large amount of root is left in the soil. It cannot be maintained that the nitrogen, to the whole extent I have stated, will be available in the shape of nitric acid; yet, if only one half becomes so available, the reason will at once be seen why a good crop of clover is almost invariably followed up by an abundant crop of corn. But in order that the beneficial effect should take place, it is most essential that the soil should be penetrated by the air, and that after growing a good crop of clover immediate steps should be taken to work the soil, for the better the soil is worked by proper machinery the sooner the clover-ley is broken up, the sooner atmospheric air enters the soil, the more rapidly the nitrogenous constituents of the root are destroyed, and the more abundantly are nitrates formed in the soil. I never



examined soil that had been well penetrated by air, without finding large quantities of nitrates present.

So much with regard to the indirect influence of the atmosphere in the nutrition of plants.

The indirect influence of the air on mineral matters, especially in clay-soils, is also most important. Clay-soils frequently contain an abundant store of mineral food, which is as essential as atmospheric food to the growth of plants; but in many cases it is so locked up that it is of little or no avail to the growing plants, and it is only when the air thoroughly penetrates the soil that it becomes available. It is by the introduction of atmospheric oxygen and carbonic acid that many mineral compounds entering into the double silicates of alumina are gradually decomposed, and the alkalies, lime, potash, soda, &c., are rendered assimilable by plants. In consequence of this remarkable action, the surface of the soil becomes more porous and powdery; and a proper aëration reduces a stiff clay-soil into fine earth, at the same time producing the food so much wanted for the growth of the plant, and that condition which enables the plant to avail itself more abundantly of atmospheric food; for the more porous the soil is, the more readily it absorbs ammonia and carbonic acid from the atmosphere. The atmosphere supplies an abundant store of food in a direct way to all plants; it also supplies nutriment in an indirect way by operating upon the organic matters of the soil, producing carbonic acid and nitrates. It operates upon the mineral constituents of the soil, rendering them soluble, and therefore available as food for plants; and lastly, while effecting all these beneficial changes in the soil itself, it materially improves its mechanical condition, whereby it acquires the power of availing itself more perfectly of the food existing in such great abundance in the atmosphere.

#### DISCUSSION.

MR. FRERE: You tell us that rain furnishes 22 lbs. of ammonia and nitric acid to the acre. You have also spoken of the nitrogen in the roots of an acre of clover being equivalent to 8 cwt. of guano; for the purpose of connecting the two statements, will you also mention the number of pounds of nitrogen in 1 cwt. of guano?

DR. VOELCKER: Good Peruvian guano contains from 14 to 15 lbs. of nitrogen to the cwt. I mentioned only one example of the quantity of nitrogen in roots and other vegetable remains that are left in the soil; but it of course varies. I am at present engaged in an inquiry into the growth of clover, and I shall follow it up by endeavouring to ascertain how far it is useful as a preparation for the wheat crop.

MR. FRERE: I gather from these premises that a dressing of 4 cwts. of guano would produce about 60 lbs. of nitrogen in different forms, or three times as much as the rainfall will produce.

DR. VOELCKER: Exactly so.

MR. HOLLAND, M.P., in allusion to the large amount of nitrogen in the roots of clover, said that in growing and managing the clover crop, it was desirable to pay as much attention as possible to increasing the

roots. If the heads only were worked off, the stems were uninjured, the plant continued to grow, and a large amount of root was formed; but if the clover was fed off, the plant was more or less injured if not killed, and no root was formed. This in considering the effect of the clover crop upon wheat would be of very great value.

Dr. VOELCKER said: The question had already occupied his attention, and he found that after two years' clover-crop, leaving the first year's crop standing for seed, more nitrogen was actually obtained than when the clover was immediately fed off. The explanation was that roots develop themselves much more perfectly when the clover-plant is allowed to grow without being checked, than if subjected to the nibbling tooth of the sheep. As the question was one of great practical importance, he hoped that in event of it being necessary to extend his observations and experiments, members of the Society in different parts of England would assist him by forwarding him specimens of clover from different localities.

Mr. COLEMAN asked whether the comparative injury from feeding, as against mowing, in reference to the wheat crop, would not depend in a great measure upon the method of feeding; whether the plan which he believed was most economical as far as the animal was concerned, viz. that of passing rapidly over the surface, allowing the crop to attain a height of 6 or 8 inches, and then at once feeding off, giving one day say to one spot—would not answer the same purpose as allowing the clover to run up to seed? It might be gathered from what Mr. Holland said, that mowing a crop would produce more of root than feeding off. That, however, was hardly consistent with his experience. If the crop was continually gnawed down, they could readily understand that, like a tree constantly topped, it would not produce root growth; but he should like Dr. Voelcker's opinion as to whether, supposing it were fed off in the way he had suggested in the case of poor but not clay-soils, they might not expect a better result.

Mr. FRERE observed that it had been the immemorial practice to plunder the pastures for the advantage of the rest of the farm; but, on the other hand, it was said that the pastures were the landlord's bank. This was a paradox which had an important bearing upon the question under their notice.

Dr. VOELCKER (in acknowledging a vote of thanks proposed by Sir John Johnstone, and seconded by Mr. Holland, M.P.) said he could not form any precise opinion as to the point raised by Mr. Coleman, but he proposed to make experiments with the view of ascertaining the amount of produce, and what was left in the ground after treating a piece of clover in various ways. With respect to Mr. Frere's question, he could only hope that those who looked upon pastures as a bank had some other bank as well. He had generally found that those who looked upon pastures as a bank from which they could continually draw, were not men who were very well to do, and certainly, if they were tenants, were of no great advantage to their landlords.

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*Meeting of Weekly Council, Wednesday, April 23rd.* Lord FEVERSHAM in the Chair.

The subject of AGRICULTURAL EDUCATION was introduced by Mr. HOLLAND, M.P., who, after a few introductory remarks, proceeded as follows:—

My Lord,—We are all agreed on the necessity of something being done in the way of education for the agricultural class. In general the subjects for discussion here take two or three different phases, according to the nature of the land, the climate, and the latitude; so that, in matters of agricultural practice, there are different views arising out of these circumstances; but education is a subject in which we all feel an interest, but which we hardly know how to handle, in consequence of our not having any particular system connected with the agricultural body. A few years ago the question would not have been mooted in this Society; but the growth of civilisation, the way in which man is now forced to exert himself, whatever may be his social position, and the manner in which he has to compete with his fellow man, require that no class should be backward in the acquirements of the age. As illustrating the question of education in connection with agriculture, I would refer to the answer of an engineer of some repute in connection with this Society, who, when asked how a young lad should be brought up for the purpose of becoming an engineer, replied, "Send him to King's College, or to some other large public establishment of that nature." Then came the inquiry, "What do they teach of engineering there?" "Never mind," was the reply: "don't think at present of his future profession; think only of his having a large groundwork, a broad basis for a good general education." The same advice would apply to the early education of a member of the agricultural body. The fact is, that whatever our ancestors may have done in the shape of education was voluntary on their parts; it was owing to the peculiar habits or tastes of the individual if he became an educated man; but now education is a necessity, and the only question is—How shall the want be met? In connection with this subject of education, everybody ought to read a pamphlet by the Rev. J. L. Brereton, Prebendary of Exeter Cathedral,\* who has not only done great service by the manner in which he has made known the wants of the middle classes, but has gone practically to work, and, through his position and peculiar qualifications, has been able to make the public, and those who have power and authority in his own county, take an interest in working out practically the views which he has submitted to them.

Education has been quaintly declared to be the placing of the growing human creature in such circumstances of direction or restraint as may make the most of him. It is the machinery for furnishing him with such information as will be practically serviceable to him in future life. In considering the question with regard to the farmer

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\* 'Education as connected with Agriculture.'



we must remember that there are three classes connected with the land: the landlord, the labourer, and the occupier. Now the reports of different public officers in this country show that the intermediate class—that of occupiers—has been sadly neglected. Mr. Bellairs, one of the Inspectors of Schools appointed by the Privy Council, says:—

“I am afraid that in my district (that is Gloucestershire, Worcestershire, and Warwickshire), there are few instances of schools for farmers, small tradesmen, artisans, and others of that class, and yet it would be difficult to mention any description of school that is more important. There is no class of society so imperfectly educated, or whose opinions are so crudely formed.”

Mr. Brereton also, speaking of the wants of the same class, says:—

“The comparative deficiencies of middle-class education in England may be attributed to the single fact, that neither in the development during this century of the higher system” (that is, the system of public schools, colleges, and Universities for the wealthier classes), “nor in the establishment of the lower” (which has reference to the State education given to the poorer classes, of which, by the way, the large body of occupiers of land, as well as the middle classes, are the chief supporters through having to pay the rates), “has there as yet been provision made for the large intermediate class who can neither aspire to the former nor condescend to the latter. There are, indeed, many advocates for so extending these two systems as to embrace all the upper middle class in the educational system of the gentry, and to absorb the remainder in that formed by the help of the State for the labourer. It is also still an open question, though not likely long to be so, whether public opinion will acquiesce in the permanent establishment of those subsidiary examinations which the Universities have recently undertaken for the middle class, or whether it will adopt the proposal to establish, in connection with the different counties, a new educational system with its own public schools, colleges, and University.”

The great mass of the middle class are without any means of obtaining an education commensurate with their wants. Referring to this, Mr. Brereton continues:—

“In either case we may hope that a standard will be gradually fixed both for general knowledge and for special studies, which will remove the existing uncertainty of object and irregularity of method, which are equally injurious to the teacher and the taught, to the school and the home.”

Then, alluding particularly to the farmer, he observes:—

“The effects of such a definite standard upon the English farmer’s family can hardly be overrated. When once it becomes recognised as the rule, that all the sons of the family should complete their education by obtaining a degree, the habits of the household would be regulated accordingly; and the mere necessary arrangements for study would open in the seclusion and frequent leisure of the farmer’s home prospects of domestic order and happiness hitherto almost unknown. Such an object alone, without reference to the means of its attainment, would insure this. For equally the holidays of the schoolboy, the vacation of the collegian, or the daily pursuits of the home student would have this effect, extending also indirectly to the female members of the family.”

Such is the farmer’s connection with the large middle class; and the section of that class to which immediate reference is now made is the agricultural section, in dealing with which the great difficulty



comes in that we hardly know whether the machinery exists for bringing into play all that can be requisite as speedily as the present generation requires. That there is a demand for it, I think there can be no doubt; but how is the demand in this section of the great middle-class to be met? During the period boys are at school general education of a public nature is all that is required. The difference between a public and private educational system is this, that the public system, being, as it were, public property, lays itself open to the approbation or disapprobation of the class requiring it for its own benefit; and at the same time, in connection with public education, a certain amount of stimulus is applied in the shape either of scholarships, prizes, or some particular mode in which honours are bestowed, giving to the individual receiving them a certain status, and, if the examinations be what they ought to be, an opportunity of displaying what there is in him. I think myself that, in the case of the children of agriculturists the nature of the education ought to be public, like that of the children of other sections of the middle classes, but that something more is also wanted. While at college there ought to be some connection between the practical working of the land and the future farmer. And here is one of the difficulties with which we have to contend. Mr. Grey, of Dilston, in the course of a speech which he made in the north some time ago, said:—

“The time has gone by with too many of us to profit by the improved education which the present state of society requires and affords; but allow me to remind such of you as have the responsibility of being parents, of the duty incumbent upon you to educate your families so as to fit them for taking a respectable position in life. It is the best patrimony which you can bestow upon them. A liberal and judicious course of education is the foundation of future acquirements; it opens up the sources of knowledge, and gives vigour and opportunity of expansion to any peculiar tendency of intellect which the mind is disposed to. Without it no man need expect to keep pace with the movement of society, or to make his way in arts, manufactures, or even agriculture—to which some knowledge of chemistry and the natural sciences is indispensable.”

Having done with education as connected with agriculture, we have next to consider agricultural education, based upon the broad foundation of general education which is to be obtained at one of the public institutions, of which I hope, through the exertions of Mr. Brereton and others, and the example set us in the county of Devon, we shall soon see many scattered over the country. Mr. Wilson, of Edington Mains, the author of ‘*British Farming*,’ gives his opinion with regard to the rising young farmer in the following terms:—

“The mere possession of capital does not qualify a man for being a farmer, nor is there any virtue inherent in a lease to insure his success; to these must be added probity, knowledge of his business, and diligence in prosecuting it. These qualifications are the fruits of a good education in the fullest sense of that term, and are no more to be looked for without it than good crops without good husbandry.”—“But the great difficulty at present lies in finding appropriate occupations for such youths between their fifteenth and twentieth years. In many cases sons of farmers are during that period put to farm-labour. If

they are kept steadily at it and are made proficient in every kind of work performed on a farm, it is a good professional training as far as it goes. The more common one—at least as regards the sons of the larger class of farmers—which consists of loitering about, without any stated occupation, attending fairs and markets, and probably the race-course and hunting-field, is about the most absurd and pernicious that can well be imagined. Such youths are really to be pitied, for they are neither inured to bodily labour, nor afforded the benefits of a liberal education. It need not surprise any one that such hapless lads often prove incompetent for the struggles of life, and have to yield their places to more vigorous men who have enjoyed the benefit of bearing the yoke in their youth. Unless young men are kept at labour, either of mind or body, until continuous exertion during stated hours, confinement to one place, and prompt obedience to their superiors, have ceased to be irksome, there is little hope of their either prospering in business or distinguishing themselves in their profession. Owing to the altered habits of society there is now less likelihood than heretofore of such young persons as we are referring to being subjected to that arduous training to bodily labour which was once the universal practice; and hence the necessity for an appropriate course of study to take its place.”—“It is also common for such youths to be sent to Edinburgh for a winter or two to attend a class of agriculture, and perhaps also of chemistry and the veterinary college. This is well enough in its way, but yet there is wanting in it an adequate guarantee that there is real study—the actual performance of daily mental work.”—“After enjoying the benefits of such a course of training as we have here indicated, young men would be in circumstances to derive real advantage from a residence with some experienced practical farmer, or from a tour through the best cultivated districts of the country.”

Again, Mr. Morton, in a lecture which he delivered at the Royal Agricultural College, laid down these three points as essentials to the young farmer:—1st. That he should have practical skill; 2nd, that he should have business tact; and 3rd, that he should have a liberal and scientific education. Mr. Morton showed that, if a man had mere practical skill, he was little better than a labourer; if he had business tact, he might not only be a labourer, but become a manager of a farm; but that, without having, in addition to capital, a liberal and scientific education, he was not fitted for holding a large farm in the present day. In this I thoroughly agree; but the difficulty is to induce the farmer to spare his sons for additional education after they are considered to have left school; and the only way in which I imagine he can be encouraged to do so is by having a portion of the expenditure on a lad repaid him by his obtaining a scholarship or prizes that will partly support him either at some educational establishment or in connection with a large farm. Now there is a want of all this, and it is one of the reasons why a committee of this Society has been recently appointed. But we must remember that the duties of the committee are limited to an inquiry into the manner in which the Royal Agricultural Society of England can assist those who are employed in obtaining their living from the land; it cannot take up the whole question of the general education of the farmer. Our discussion, therefore, has nothing to do with the operations of the committee, although, from what I know of its members, I dare say they will more or less take the view which I am advocating, and be very glad to make themselves acquainted with the opinions of the gentlemen now assembled.

My views are these : That, following the example set us in Devonshire, we ought to do our utmost, not as a society, but as members of the agricultural class, to establish a system of public schools throughout the country as opportunity presents itself ; that whilst the farmer's son is availing himself of the advantages thus offered, we ought to give him encouragement, by showing him that if he will but exert himself and bring out the talent that in him lies, he will gain honours and attain a status. And then we ought to follow that up by enabling those who have gained such honours further to make themselves perfect in their profession by having the advantage of attending where a scientific education is bestowed, or studying the practice upon a farm. This is the only way in which we, as an agricultural body, can work until the time comes, as I hope and trust it will, when, from the benefits accruing to the sons of occupiers of land who, through their own and our exertions, have been enabled to obtain a better education, or an education from which they are now entirely shut out, agriculturists themselves will step forward and join us in the great work of improving the educational condition of the farming class of this country.

At the conclusion of Mr. Holland's address,

Sir EDWARD KERRISON, M.P., said he was sure they would all thank Mr. Holland for the able manner in which he had introduced a subject that had been kept in abeyance much longer than it ought to have been by the Council of the Society, seeing that, according to their charter, it was one of their functions to encourage the education of the agricultural classes. Mr. Holland had mentioned the name of Mr. Brereton and his successful exertions. He (Sir E. Kerrison) had visited that gentleman's school, and had there seen the pupils, consisting chiefly of the sons of agriculturists, maintained and educated at a cost so reasonable as to be within the means of almost any farmer of a tolerably sized occupation, and some of these pupils had since passed the only test hitherto existing for the middle class, viz., the Oxford and Cambridge middle class examinations. A conversation which he had had with Mr. Brereton led him to consider whether efforts for the improvement of the education of the middle class should not be made in so general a way as to provide not merely an education for particular sections of that class, such as the agricultural, but for the whole middle class of the country ; for Mr. Brereton's remark was undoubtedly true, that in many instances the sons of farmers were desirous of going into commercial life, whilst the sons of commercial parents were often desirous of becoming farmers. Consequently, the training in any school, to be beneficial to all, should be general ; for it was well known that there was no limit to the trade of the country, but there was a limit to the land, and although year by year, owing to increased knowledge and energy, the produce of farming might be augmented, yet, excepting in a few instances, where fresh land was brought into cultivation, farms could not be increased in number. On the contrary, the tendency of the present time, and he regretted it, was to do away with small farms, and thereby reduce the number of



occupations open to the sons of agriculturists. For this reason it was the more necessary that the Council, in any system of education they encouraged, should be careful not to give prizes to those schools alone which confined their attention to the education of agriculturists. Many schools had been started on the public school principle, which was the only one, he thought, for which success could be claimed. For what test had the upper classes after their sons had been at a private school, but the test of a public school? Supposing the farmer to pay a sufficient sum for the training of his boy at a private school, and to be unwilling that he should undergo the test of the middle class examination, what incentive was there in a school of thirty or forty pupils for boys to prepare themselves for a wide and searching examination? In larger schools the incentive to work was much greater, inasmuch as with a greater number of boys the prizes given, however small in number, acted as a stimulus, and proved to the parents the amount of proficiency attained by their sons. There was already a school at Lancing, in Sussex; at Hurstpierpoint a still larger one for a thousand boys was rising. There was also one in Suffolk, with which he himself was connected, and for which a sum of 14,000*l.* had been raised by the voluntary contributions of the gentry. The school in Suffolk, which would be opened in October next, was designed for all classes, not agriculturists alone; and in order to anticipate the objection that the education it would afford would be so good that the higher classes chiefly, instead of those for whom it was more particularly intended, would avail themselves of it, he might state that it had been determined that the whole cost of board and education should not exceed 2*l.* per annum, to include all expenses. Now, supposing they had 300 boys to deal with, they could afford to give for this money a far higher education than a small private school could.

With the feeling that appeared to animate gentlemen in so many counties where they were about to commence the formation of schools of this sort, the Council of the Royal Agricultural Society would be very wrong if they did not lend a helping hand to those who so proposed to make personal sacrifices for the sake of the farmers of this country. The Council here would not pretend to send inspectors to such schools, or go through forms of that description; but if papers on agricultural subjects by pupils in the different schools were sent up to their professors (who he had reason to believe would willingly give their aid), and if to the authors of the most deserving papers prizes,—or better still, scholarships were awarded,—the examination would give an assurance to the farming class that at least the particular school which trained the successful candidate was teaching the boys the elements of what they had afterwards to learn practically. It was difficult to know what to do with boys between fifteen and twenty years of age; but as a rule they did not remain at school after they were seventeen. He thought, therefore, that previously to that time the province of the school should be to give them as sound and good an education as possible; they would then learn to apply to practice their scientific



attainments in chemistry, &c., in the course of a few months spent upon a farm after leaving school, to far better purpose than on any number of farms connected with the college.

The Rev. PREBENDARY BRERETON said that last year it was a question whether his school at West Buckland, in Devonshire, could keep within the estimated expenditure. It had now been going on for about five years. It began with two or three boys only, and there were now sixty. The terms were 20*l.* a-year for boys under thirteen, and 25*l.* for those who were above that age; but this year the charge for the younger boys had been raised to 23*l.*, and that would make the average 24*l.* Last year the payments for the boys fell short of the expenditure by 51*l.*; but during the quarter just ended the expenses had been more than covered by the payments, the latter amounting to 383*l.*, and the cost of board to 243*l.* All the other expenses last year for salaries, taxes, &c., came to 415*l.*, and, estimating these at the same rate this year, he calculated upon having a surplus of 145*l.* or 3 per cent. upon the capital. The head master received 120*l.* a-year, and was provided with a house to live in. Two under masters had 40*l.* a-year each, and their board was reckoned at about 20*l.* each, for forty weeks at 10*s.* a-week. The cost of the boys' board was 8*s.* a-week each. The head master had also assigned to him any profits that might remain over and above a dividend of 3 per cent. Of course the boys were not clothed by the institution, and those who learnt Latin paid extra; otherwise the 25*l.* a-head covered all expenses. The food was as good as could be desired, and there was an undoubted inclination displayed by the higher classes to avail themselves of the benefits of the school; but the check upon this disposition was to keep the expenses down, and if boys came there who required classical education and extras, to make them pay at a higher rate. Since the commencement of the school he had traced many of the boys, and found that a good proportion of them had turned to farming. At the outset he thought that practical farming might be connected with the school, but local circumstances obliged him to keep the farm altogether distinct. It was carried on, however, contiguous to, though not connected with, the school, in the hope that some pupils would be glad to receive a special education there. As yet the experiment of the farm had not decided him whether such a combination was desirable, though he had met with pleasing illustrations of the advantage of letting instruction in practical farming keep pace with the education given in the school.

For the raising of capital to establish other schools he approved of the principle of limited liability: a strict examination of the accounts was sure to be a check upon the master and matron. When there was a profit the shareholders could, of course, do what they liked with it; but if they appropriated it to the augmentation of the masters' salary, or as prizes or scholarships, as had been done in this school, all parties would be interested in keeping the expenses down, and there would be no danger that the desire of realising a good dividend might induce the proprietors to neglect the true interests of the school. He could honestly confirm the statement of Sir Edward Kerrison that for about

21l. or 25l. a-year a good English education might be given; but though it might include French to a certain extent, and mathematics, a classical education equivalent to that of the upper classes could not be had for that sum.

Dr. VOELCKER, speaking from his experience in the education of agriculturists, said he was convinced that the practical education, such as is required by the sons of small tenant farmers, was much better acquired at home than upon a farm attached to a school. The farm, moreover, was an expense which fell heavily upon agricultural schools, and without it, he believed that with some little care they could be made self-supporting. They required to be supported by the influential men of the county, and such encouragement as Sir Edward Kerrison had suggested that this Society should afford would be most beneficial; but it was in vain to hope that anything like a good professional education could be given in any establishment especially set aside for the instruction of the farmer. It was impossible to instruct more than three or four pupils together in one business. Wherever there were a number of lads brought together, they would be sure to do anything but what they ought to do. In school they could be kept under perfect control; so also in the lecture-room; but it was practically impossible to give to a number of young men instructions in classes upon a farm. The sons of wealthy farmers required to be specially instructed in the great art of making experiments, and of deriving advantage from a more careful observation than was, perhaps, needful on the part of the small tenant farmer, for the simple reason that the latter had not the means at command of bringing into play the fruits of a superior education. A lad, who, up to his fifteenth or sixteenth year was instructed in the elements which were usually taught in general schools, and in addition, perhaps, in the elements of natural science, especially chemistry, would, when occupied upon the farm, practically turn out a much better agricultural chemist and a more careful observer of the facts of natural history than the lad who was instructed with special reference to his occupation in the elements of a particular branch of science, such as chemistry or botany.

Professor COLEMAN entirely agreed with Professor Voelcker that there was a difficulty in commanding the attention of large classes of students upon a farm, and making the instruction sufficiently personal to be of value. At the same time, he could not admit that much information might not be derived by students from the teaching of the farm. If success in practical farming depended so much upon local experience,—and the practice depended largely on soil and climate,—it would be absurd to suppose that instruction upon a farm, irrespective of its situation and soil, would fit the student to take charge of a farm, and embark a large amount of capital upon it, where the conditions were altogether different. But that much useful general information, available for future development with reference to special cases, was thereby conveyed he certainly believed.

Mr. WREN HOSKYNs said that the subject of agricultural education was one that had always presented considerable difficulties, partly owing to a sort of ambiguity in the expression itself, and partly from

the nature of the class to which it was applied. The question that Mr. Holland probably intended was, how far education might itself be so adapted and directed as to convey some special advantage to agriculturists as a class. Now, that embodied a very considerable difficulty, because he was not sure whether they were right in speaking of farmers as a class at all; for how could they classify under one head a body of men extending from the occupier of 30 or 50 acres up to the person who might be the owner of 2000 or 3000 acres, which he was absolutely farming himself without the assistance of any tenant-farmer? The class was so extensive that any attempt to legislate, so to speak, for it would be entirely futile, because the body to which the legislation would apply would require a hundred or more different modes of treatment. But the question of education, if attempted to be applied to the wealthier class of agriculturists, would be regarded as almost a presumptuous interference, because they were well able to educate their own sons, and were assumed to be well educated themselves. The very separation, however, of that portion of the agricultural classes from consideration, necessarily reduced the question to the education of the poorer classes of farmers, who, Professor Voelcker said, must be the special subject of consideration. Now there was a greater difficulty respecting the education of that class than, perhaps, of any other body of men in the country; first, because they were so widely separated from each other, and individually so far removed from the influence of education; and next, because the practice of agriculture—that was to say, constant occupation from six o'clock in the morning until six o'clock at night in the business of the farm—was so exceedingly detrimental to the exercise of the mental faculties during the remainder of the day. Unless, indeed, a portion of the early part of the day were cut and carved out, and absolutely devoted to the purposes of intellectual culture of some kind, no good could be done, for the attempt to put books in the evening into the hands of persons who had been the whole day occupied upon a farm, a plantation, or an estate, was almost futile.

They must, therefore, in their deliberations in the committee, and even at that moment, address themselves to this point—What were the means by which they could bring educational influences home to the farmer? Beside the establishment of schools, it was important for the committee to consider—How, through the aid of this Society, to bring to bear upon the home life of the poorer class of farmers, and particularly their sons, the most powerful educational influences. When, after the death of Mr. Pusey, the discussion took place respecting the 'Journal,' an opinion which found some favour was that of cutting up the publication into smaller dimensions, so that it should be more available for practical home-reading, converting it, as it were, into a sort of 'half-hours with the best agricultural authors.' Thus it was hoped to bring before the agricultural mind, with little difficulty, subjects that would evoke and excite intelligence in reference to the particular pursuit in which it was engaged.

When he acted as a juror during the International Exhibition, he remembered being asked by the foreign members of the jury, what



was the amount of the agricultural produce of England, what were the particular productions of the east or the north of England, and a number of other questions, which it struck him at the time no English farmer ever asked, and which he was afraid very few of them would be able to answer. But to French, Germans, Austrians, Portuguese, Americans, and Canadians alike, he was obliged to return the humiliating reply that we had no means of ascertaining what was the agricultural produce of the country; and so surprised were these gentlemen that they seemed to be really incredulous of the fact. He had alluded to this subject, because it was one of the matters which he should like to see occupying the attention of the farmer and his sons, leading as it would to the question of what was the agricultural produce of other countries. He had often heard farmers who suffered from low prices speak of the quantity of foreign corn that was imported into the country; and they did so evidently without any knowledge of what was the best course for them to take under the circumstances, simply because they had no means of ascertaining what the resources of the world were in respect of the different kinds of grain; of barley, as compared with wheat, or oats as compared with barley; what kind of climate was most suitable for barley or oats; and how far competition was likely to be greater or less in different kinds of grain. He had glanced at these topics because they were constantly spoken of by farmers in the markets, and in conversation with their landlords and each other; and he had remarked that farmers took a great degree of interest in them. He feared, however, this Society had not quite done its duty in bringing these subjects forward in a manner that would add to the intellectual enjoyment of their pursuit, although they were topics to which farmers would most readily address themselves.

The CHAIRMAN, in moving the thanks of the meeting to Mr. Holland, said he should be extremely gratified if the committee felt it their duty to recommend some general practical plan upon the subject, and also considered it expedient to propose that some prizes should be offered by the Society for the most proficient of the pupils educated at the proposed schools. It would, perhaps, be difficult to carry into effect any practical plan during the present session; still, if they had a report from the committee, it might be considered by the council; for such an important matter could not fail to excite very great interest and discussion. The cost of such institutions would, no doubt, be considerable; and if land were added to each of them, it would greatly augment the cost. Suggestions had been made by various gentlemen with regard to the appropriation of the funded property of the Society; for example, that, instead of investing it, it should be employed in some other way in order to enlarge the operations of the proposed institutions. If it were to be appropriated to any purpose of the kind, he should certainly say that the best plan would be to expend a portion of the funds in the establishment and support of prizes and scholarships. It had been truly observed by Sir E. Kerrison that they could not increase the quantity of the acreage of the country. They could, however, greatly augment its cultivation;



and he might mention that he had seen a letter from Mr. Hudson, of Castleacre, to Mr. Mechi, dated Dec. 5, 1863, in which the writer said "You are quite right in saying that the lands of England are not much above half-farmed. Depend upon it there is not nearly enough capital employed upon them." In that opinion he (Lord Feversham) also concurred; and the difficulty undoubtedly was to make sufficient manure, or to obtain it at a fair price.

Mr. WELLS, in seconding the motion, observed that the preponderance of opinion expressed that day was rather against giving special instruction, either in the new or existing schools, for the education of the agricultural classes. He should be glad, however, to see the special education of agriculturists as far as possible promoted; and he thought that, without attaching farms to the schools or colleges, such a special education might, to a certain extent, be imparted. If the elements of chemistry and a rudimentary knowledge of the steam-engine were specially encouraged in these schools, he considered that it would be very advantageous.

Mr. HOLLAND, in reply, said it was satisfactory to find that they were all agreed on the point that the basis of instruction for a well-educated Englishman, whatever his after profession, should be public and liberal, including all branches of natural science as well as mathematics. After a lad had quitted school, if he had to become a farmer, he must have practical knowledge, and that practical knowledge must be connected with science; science and practice must go together; and the difficulty was, how that knowledge was to be given to the very large and scattered class to which Mr. Wren Hoskyns had referred. The class, however, might be narrowed by remembering that those who farmed their own land, or were occupiers of very large farms with ample capital, were more or less blended with the class above them. That, therefore, would diminish the number of those to whom they would have to pay attention; and if they looked to the small farmers, Mr. Brereton, in his pamphlet on education, had marked out a limit by drawing the line at the holders of farms from 300 to 500 acres, just to show that the object was to assist those who were not able from circumstances to take advantage of the institutions which were already in existence for the classes immediately above them. The committee would go to work as soon as they possibly could.

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*Meeting of Weekly Council, Wednesday, June 8th.* Mr. THOMAS RAYMOND BARKER in the Chair, Professor SIMONDS delivered the following Lecture,

#### ON SMALL-POX IN SHEEP.

Professor SIMONDS said:—The disease recognised under the term small-pox in sheep is one of considerable interest to the agriculturist, firstly, because of the rarity of the affection; and, secondly, because of the fatality it produces among the animals that are its subjects.

#### SHEEP-POX NOT IDENTICAL WITH SMALL-POX IN MAN.

The term small-pox has sometimes been objected to on the ground

that the disease is not positively identical with that which is so called in the human subject. There can, however, be no difference of opinion between medical men as to the intimate analogy which exists between the two affections; and it may be said that they are as closely allied as it is possible for any two diseases to be that affect animals of different species. Indeed, it has been rightly observed that they agree as much as any two mushrooms of different species, or any two algæ, or vegetables of other low class, may be said to do. Such being the case, the propriety of the term that has been given to this affection cannot be questioned, although the term itself may have led to some incorrect conclusions on the part of individuals, *e. g.*, that the disease having had a prior existence in the human subject, had spread through ordinary infection from man to the sheep; or that having had its origin in the sheep, it was liable to extend from the sheep to the human subject. Both these views are erroneous. The outbreaks of sheep-pox in this country can in no way be traced to disease of prior existence in the human subject, and its communication by man to the sheep; nor can we say that the disease, having appeared in the sheep, has spread to the human subject. Speaking in general terms, and bearing in mind that these diseases are of distinct species, although so closely allied, I think we may say that the small-pox of sheep, so far as we are acquainted with it, is an affection which belongs exclusively to the sheep, and has not yet been proved to be capable of being communicated to either the human subject, or any domesticated or even wild animal. Experiments on a very large scale have been instituted, and these have been invariably attended with negative results. In the year 1848, when the affection was exceedingly rife among sheep, acting in conjunction with Mr. Marson, Surgeon to the Small-Pox Hospital (who is considered to be one of the highest authorities in variolous diseases in this country), and Mr. Ceeley, of Aylesbury (who has devoted almost his whole life to affections of this description, and is employed by the Government to see that the vaccine matter supplied to the hospitals is obtained from proper sources), I inoculated several children with the virus of sheep-pox, and, in every instance, we failed to produce any special disease. Abortive vesicles rose on the arm in some cases, but came to nothing. I may further say, that, in inoculating sheep, as I have done now on rather a large scale, it has not unfrequently happened that, owing to the sheep plunging about, the needle charged with the virus has entered my finger, and I have thus accidentally inoculated myself probably not less than from 15 to 20 times, yet I have never experienced the least possible inconvenience. It has also happened that in the same accidental manner I have inoculated shepherds and men who were assisting me in performing the operation. In these individuals, too, there has always been a negative result. It is well that one can speak in this positive manner, because a notion has been entertained by labourers and other uneducated men concerned with sheep, that they and their families are likely to contract this variolous disease, and some of them have almost hesitated to assist me either in the examination or inoculation of

sheep, from an apprehension that they themselves would become affected. I will not dwell further on this part of the subject, except to say that experiments have shown not only that our ordinary domesticated animals are insusceptible to the action of the virus, but that it is likewise the case even with the goat, an animal closely allied to the sheep. I have inoculated many goats, and several of them three and four times over; I have also kept them among hundreds of variolous sheep for weeks together, and yet I have never seen one suffer in any way from the affection.

#### ORIGIN OF THE DISEASE IN ENGLAND.

I come now to speak of the outbreaks of the disease that have occurred in this country, which is necessary, because some persons have thought that small-pox is of spontaneous origin. This view was entertained by many, and especially during the outbreak in 1862 in Wiltshire, because we were not able to trace precisely the manner in which the disease was carried there. Persons who hold the opinion that special affections may arise from a combination of ordinary causes, laid hold of the fact of the appearance of the disease in an isolated part of an isolated county of England, where there was little traffic in sheep, as good proof of the spontaneous origin of the disease. I may here, however, adopt an expression of Dr. Wm. Budd, of Clifton, who read an excellent Paper on this subject before the meeting of the British Association in August, 1863, and say, with regard to the spontaneous origin of these diseases, that for a thousand years or more we have been endeavouring, in every way possible, to manufacture a special poison; that is to say, we have brought into operation all known causes of disease, and all combinations of such causes, not only in animals but in ourselves, and we have hitherto failed, with any combination of these causes, to produce a single instance of a special poison. We cannot manufacture the poison of the rattlesnake, or a special animal poison of any kind or description. Thus you see that all common or ordinary causes are perfectly inadequate to account for the introduction or appearance of this disease into England. The affection has been described most accurately by continental writers from the earliest times, and perhaps there is scarcely a part of the Continent where it has not frequently existed. Were I to start off now on a mission, I believe I should have no difficulty in reaching the disease in 48 hours in several places, here and there, on the Continent. Yet strange to say it has been reserved for the present generation to become acquainted with the introduction of the disease into England, which was connected with the free importation of foreign sheep. The disease was first introduced in 1847 by some sheep which were so far the subjects of the malady that the seeds of the disease,—the morbid matter,—were lying in a dormant or latent condition in their systems at the time. These facts were laid before the public in a work which I brought out in the year 1848, in which I traced every individual lot of sheep imported; the vessel which had brought them

here; where they were sent, and all about them. I gave the full history, and the correctness of my statements has never been disputed.

I have another object, however, in directing your attention to the two outbreaks of the disease. At the time I wrote that work, I believed, from all the researches I had then been able to make, that England had been entirely exempt from the affection until 1847, although there are most satisfactory accounts as to the progress of the disease on the Continent, from the latter part of the fifteenth century down to the present time. A year or two afterwards, however, on looking through some old works upon diseases of this nature, particularly measles and small-pox in the human subject, I met with one by a Dr. Fuller, dated 1730, in which the author labours to establish the fact that variolous diseases are distinct and separate; and not only so, but that if a disease such as small-pox cannot be communicated from the animal to the human subject, it cannot be regarded as a similar affection. Then, taking up the view which I have combated, viz., that we do not require positive identity, but an analogy between these affections,—he says:—

“The small-pox and its spurious sorts are peculiar to man, exclusive of all other animals. Mr. Mather, indeed, in his letter from Boston, in New England, saith that Dr. Leigh, in his natural history of Lancashire, reporteth that there were some cats known to catch the small-pox, and pass regularly through the state of it; and at last he telleth us, we have had among us the very same occurrence. But if we had seen and examined the matter, perhaps it would have been found a very different thing from our own small-pox. For, in like manner, there was about the year 1710 or 1711, upon the Southdowns of Sussex, a certain fever raging epidemically among the sheep, which the shepherds called the small-pox, and truly in most things it nearly resembled it. It began with a burning heat and unquenchable thirst. It broke out in fiery pustules all over the body. These pustules matured, and, if death happened not first, dried up into scabs about the twelfth day. It could not be cured—no, nor in the least mitigated by phlebotomy, drinks, or any medicines or methods they could invent or hear of. It was exceedingly contagious and mortal, for where it came it swept away almost whole flocks; but yet it could in no wise be counted the same with our human small-pox, because it never infected mankind.”

Any one familiar with sheep-pox, upon reading this account of Dr. Fuller, must come to the conclusion that in 1710 or 1711 the disease existed among the sheep in Sussex; but as to how it came there, how long it continued, and by what means it was got rid of, we are entirely ignorant. We have thus a history of the first outbreak, in 1710; the second in 1847, extending down to 1850; and the third which occurred in 1862 in the county of Wilts.

#### THE SHEEP-POX IN WILTSHIRE.

There are some few circumstances which at least afford a fair presumptive evidence as to the manner in which the affection was intro-



duced into so remote a part of England as Wiltshire. It must be borne in mind that just previously to, and also after, the appearance of the disease in this county the malady was existing in Hanover and parts of the duchy of Lauenberg, where these and other States unite. At that time we were drawing our chief supplies of foreign sheep from these districts, shipping them at Hamburg, and Tomming, as the chief ports of Slesvig, Holstein, &c. There can, therefore, be no doubt that we were importing sheep from a district that was to a considerable extent infected; and we may presume that some animals in whose systems the disease was incubated were thus introduced into England. The sanitary police regulations in those countries with regard to the exportation of diseased cattle would, no doubt, prevent any great number from coming here; still with an affection like this, which no man can recognise while dormant in the system, we can well understand that a few sheep may have passed the police regulations and found their way into England. With this we must couple another well-established fact, namely, that butchers have now for some years past been in the habit to a very large extent of making their purchases in the metropolitan market for the supply of various parts of England. Instead of drawing their supplies, say for Birmingham, from the surrounding neighbourhood, they purchase oxen and sheep in the London market, put them into railway trucks, and send them down to Birmingham to be slaughtered. And this is the case with almost all the large towns, even as far down as Manchester. The camp at Aldershot, too, is supplied almost entirely in this way. Again, we find with regard to some of our seaports, such as Brighton and Dover, where soldiers and sailors are congregated in large numbers, that to these places also cattle and sheep are sent every market day from the metropolis. These facts lead me to think it not improbable that some diseased sheep were purchased in the metropolitan market, and found their way westward. Where they went to few know, and I dare say that those who could throw a light upon the subject would hardly be disposed to do so. Unless we have, so to speak, their confession, we shall, however, never be able to arrive at all the facts of the case. But I will further presume that the period of incubation had passed in these sheep, by, or nearly at, the time when they had arrived at their destination in the West. The person who had purchased them, seeing an eruption of a peculiar kind break out all over their bodies, would be convinced at once that the animals were of no use for human food, and that he must by some means get rid of them. For when the disease shows itself, there is not only this remarkable eruption on the body, but also great constitutional disturbance. The animal sickens, it holds its head down, its ears are lopped, it refuses all food, it is the subject of intense fever and suffering; and, supposing that nothing is done, it drags out a miserable existence up to the time of its death. I believe that something of this kind must have shown itself. The man would then say, "These sheep are of no use to me to dispose of as food; I must get rid of them somehow;" and accordingly he did get rid of them by sending them

probably to a manure manufacturer for the sake of the salvage. I say a manure manufacturer, because I have to make mention of another fact, which I think will assist in accounting for this outbreak. It is this: the sheep belonging to Mr. Parry, of Allington, near Devizes, which were the first attacked in the county, were during the months of April and May fed in a field on the side of the canal connecting the Avon with the Kennet; and they were there for very many weeks. Within a mile from this identical field, is a very large manure manufactory. To that manufactory bones and all sorts of animal refuse, collected by individuals from Wiltshire, Berkshire, and the adjoining counties, after being accumulated at Devizes, are sent up by boats. Now, I was consulted with reference to the appearance of the disease in Mr. Parry's flock in July, 1862; and seeing the state of things which then existed, I was enabled, from my practical knowledge of the affection, to say at once that the disease had been existing in the flock for many weeks; and on tracing it back case by case, I arrived at the conclusion, which I stated to Mr. Parry, that his first sheep became affected with the disease about the first week of May. In endeavouring to throw light upon the outbreak, I visited the manure manufactory, and was allowed by the proprietor to go all over it; and in a shed where the materials to which I have referred were stored, I saw not merely the bones of sheep and other animals, but, very much indeed to my surprise, heads, legs, and portions of the bodies of sheep with the skin on, evidently showing that sheep, from whatever cause they might have died, had been cut up, skin and all, and sent here for the making of manure. I do not mean to say that any examination of these refuse materials showed that the skin was in a diseased condition; but in that manufactory I distinctly found the refuse matter of sheep cut up in the way I have described. I also ascertained from the books of the factory that a boat-load of refuse animal matter was received from Devizes on April 29th. I believe, then, that some sheep affected with small-pox were cut up in the manner I have stated; that the materials went along the canal in boats; and that Mr. Parry's sheep, being on the banks of the canal at the time, were infected by the special morbid matter which spread from the mutilated carcasses of these small-pox sheep. It is singularly confirmatory of this theory that a bridge crosses the canal close by, so that when boats meet there one must wait for another to pass before it can proceed further: and it is not improbable that from some such cause there may have been a delay in the passage of the boats at that identical spot. Of course this is all presumptive evidence; but if we couple all the facts and presumptions together, I think we may arrive at a tolerably fair conclusion with regard to the cause of the outbreak of the disease in Wiltshire.

#### DIAGNOSIS OF THE AFFECTION.

In the next place, I come to speak of the nature of the disease, and to describe the symptoms by which we recognise it in its several successive stages. First, as to the period of incubation. Judging

from what we see of the progress of the affection in a large lot of sheep, and from the experiments made with a view to determine this important point, we have come to the conclusion that there is little variation in the time of incubation. The disease may appear on the ninth day, or may be protracted to the eleventh; but speaking generally, ten days may be regarded as the period of incubation. At the end of this time the sheep sickens, refuses its food, has a hurried breathing, accompanied by a hot state of the skin, an almost unquenchable thirst, a bloodshot condition of the eyes, and a discharge from the nostrils. All these are indications of the febrile state of the system, and simultaneously with it a particular eruption takes place on the body. If the eruption is very copious, the case assumes what is generally called the confluent form; that is to say, the papulæ (or pimples) coalesce and run together, as it were, in chains. At times the papulæ are distinct and separate, and then we speak of the case as mild. We divide the small-pox in sheep, therefore, into two varieties, the same as in the human subject,—the benign small-pox and the confluent small-pox. This, the second, stage of the disease, speaking of the condition of the skin alone, lasts for three days, when a peculiar change is observable in the papulæ, which, instead of being red, and thus showing a high degree of inflammation, assume a white appearance. Invariably, when the disease has reached this point, there is a slight abatement in the severity of the symptoms. The fact is very remarkable, that the morbid matter which has entered into the organism of the animal, through the medium of the tainted air, and has been lying hidden for ten days, has nevertheless during the whole of that time been appropriating to itself some of the materials or constituents of the blood, and multiplying to such an extraordinary extent as to lead to a copious eruption on the skin. But this eruption is nature's own conservative power; her means of ridding the system of the poison which has grown within it. The vesicles which rise on the summit of the papulæ cause their colour to change from red to white; the scarf skin raised by an effusion of fluid beneath, constituting a sort of blister. Every one of these vesicles will yield that same morbid matter in a sensible form, which has entered into the organism in an unrecognisable form. It is, therefore, in this stage of the disease that we can obtain the material for any experimental purposes for which we may require it. In consequence, also, of the morbid matter being thrown out on the external surface of the body, the constitutional symptoms are considerably relieved. In the next or ulcerative stage, we observe that a great number of the vesicles burst, their contents are lost, and they dry into thick brown scabs. Some decline entirely, while others go on to ulceration. When animals reach this stage of the disease, we invariably find an increase of the constitutional symptoms; for though in the vesicular stage the disease is not fatal; animals which have held out so far are almost certain to die if ulceration follows. According to the general strength of the animal's constitution, and the treatment and management observed towards it during its illness, we date from this time the recovery of the animal, but this is accompanied with



similar results to those we find in the human subject, viz., pocked faces, and a cicatrised surface of skin.

### FATALITY OF SHEEP-POX.

The fatality of the natural disease in a flock of sheep when unchecked, except by the removal of infected sheep, and by observing a careful system of management towards them, will not unfrequently reach as high a figure as 50 or 60 per cent. Where circumstances have been unfavourable I have known the disease to destroy 90 per cent.; and if we take animals originally the most healthy, and place them under the most favourable circumstances with regard to weather, management, medical treatment, and diet, it very rarely falls below 25 per cent.

### REMEDIAL TREATMENT.

In speaking of the means at our disposal to lessen the fatality of the disease, and to secure animals against a natural outbreak of the affection, two or three things offer themselves to our consideration. One course is the early separation or segregation of the animals. This plan has been a good deal too much extolled by individuals who possessed only a limited experience of the affection. I readily admit its value, nobody perhaps more so; but I say that we must not depend exclusively and entirely upon it, for in practice we find that the disease may break out in a flock consisting of 800, 1000, or 1200 sheep, as it did in the breeding-flock of Mr. Parry, Mr. Neate, and other gentlemen in Wiltshire. No man can tell the hour at which the eruption will come out; but from that very moment, if not before, the disease is infectious. An examination, or at any rate a close inspection of every individual sheep two or three times a day, is therefore necessary. But even more than this is essential, in order to make sure that no small-pox sheep is left in the flock. As the disease frequently assumes a benign character, there may be benign cases not easily recognised in the flock, and though these will not in themselves be dangerous, yet an animal taking the disease from these may have a severe instead of a benign attack. Therefore, these benign cases must be looked after very closely; for as the animals, especially early in the disease, do not lop their ears, nor drop their heads, nor refuse food, it is possible they may be left in the flock and do irreparable mischief. Practically, then, every sheep should be caught each day and turned up, and its arm-pits and other parts examined to see whether it is affected with the disease. But who, I ask, would like to incur the labour of thus examining 1200 sheep, and rely on the results of this search as his only safeguard? Suppose as a parallel case, that there were a public institution in this metropolis where there were three or four hundred children who have been neglected in early life, and have not been protected against small-pox by vaccination, and two or three individuals who became infected with small-pox were allowed to mingle with these children for an hour or two every day. I will further suppose that the surgeon of the establishment, knowing that these



poor children are thus exposed to the disease, instead of having recourse to vaccination to protect them, goes amongst them day by day, and questions them as to whether they have a headache, feel sick, and so on; and that on finding a child who says it does not feel well, he sends it away; that on the following day he finds another child making a similar statement, and this he treats in a similar manner. Is it not obvious that a system of the kind, so long as it is carried out, will be the means of keeping up the disease, whether among children or sheep? So much, then, for the separation, or keeping apart, of infected animals.

The next suggestion, which rests entirely on the same ground, is that of taking away the affected animals and killing and burying them with their skins on, so as to prevent their doing any further mischief. I can imagine that under certain circumstances a man might go on killing his sheep, one after another, until he had destroyed his entire flock, and during the whole time be keeping up a source of infection that would spread far and wide. I am, therefore, no advocate of a system of this kind.

#### THE VACCINATION OF SHEEP.

The vaccination of sheep as a preventive measure is a very important question; and I am happy to say that it has now been set at rest, if not for ever, at any rate for a considerable length of time, in consequence of the measures adopted by the Government, arising out of the recent outbreak of disease in Wiltshire. In order to determine the prophylactic value of vaccination, the Government purchased 200 sheep, which were placed under the care of Mr. Marson, the Surgeon of the Small-Pox Hospital, and myself. Those sheep were placed on a farm then in my occupation, in the immediate neighbourhood of London, that we might carry out a series of experiments upon them, to ascertain whether vaccination was protective or not. The Government had this question forced upon it by communications which appeared in the public papers at the time, from some leading agriculturists in the counties of Norfolk and Cambridge, and also from surgeons in the latter county, who strongly recommended the vaccination of sheep. Foremost among the Norfolk agriculturists, was Mr. Henry Overman, of Weasenham. That gentleman said in effect that during his late father's life the small-pox showed itself in their neighbourhood, and that his father vaccinated the whole of his flock; that the sheep took the vaccine disease; that they were protected from the small-pox; and that any man who preferred inoculation to vaccination was little better than a madman. Statements also came from other persons, to the effect that they had vaccinated their sheep, and that they did not take the small-pox: but many of the parties did not even say whether or not the sheep had ever been exposed to the disease. Coming back, however, to the late Mr. Overman: this gentleman stated, at a meeting of an agricultural society, held in Norfolk in 1848, that as a letter of sheep (Southdown rams), he conceived it to be his duty to send them out as free from disease as he possibly could, and therefore, when the sheep-pox showed itself

■ in his immediate neighbourhood, he had recourse to vaccination. He went on to say, "I had 860 sheep vaccinated; I am very glad I did so, for I have not had any disease among them. I had subsequently to that 20 score of lambs vaccinated, making altogether 1260." Twelve hundred and sixty sheep were vaccinated, he said, and none of them had taken the disease.

Now I have good reason to believe that these 1260 sheep of Mr. Overman's were not vaccinated at all. The same gentleman who did these sheep also vaccinated, as it was said, a large number of sheep for Mr. Hudson, of Castleacre, a member of the Council of this Society. He likewise vaccinated, as he called it, a large number of sheep for other persons in that neighbourhood; so that, in all probability, he operated upon not less than from 3000 to 4000 sheep. Now, I might ask any one who knows anything at all about the matter, where did all the lymph necessary to vaccinate 3000 or 4000 sheep in the course of about two or three weeks come from? I find, however, that this gentleman had no difficulty whatever about it. He carried lymph, as he termed it, in phials pretty well filled to the brim. He used this material on the sheep generally, and he used it on the late Mr. Overman's sheep, with the exception of about twelve. According to an admission made by Mr. Overman himself to me there were certainly not more than twelve of his sheep that were vaccinated from *points* charged with vaccine in the ordinary way, and he added, "I did not see any difference between the vaccination done by points and that done by fluid, and I am satisfied, therefore, that all my sheep have been vaccinated." I have already stated that a number of sheep were done in the same manner for Mr. Hudson. In the course of a short time, however, Mr. Hudson's sheep, being exposed to the influence of natural small-pox, took the disease, and it went on rather severely in his flock. He then had recourse to inoculation; but the person who was consulted, and who inoculated the sheep, knew practically little or nothing about it, and the sheep were consequently done in the most objectionable manner. Instead of taking the smallest lancet, or a needle, and just soiling it with the virus, and introducing the virus with one puncture under the skin, so as not to draw blood, he made large incisions inside the arms of these poor sheep, inserting bits of tow charged with lymph and pus; and that he called inoculation. I witnessed this for myself, and never saw so painful a scene. Besides the sheep which died, others suffered from the sloughing of wounds the loss of an ear, the loss of an eye, and so forth. So far as the pecuniary question was concerned, many of the survivors might as well have died as lived. Well might inoculation carried on in this manner have got into disrepute in Norfolk! I mention one other case. A natural outbreak of the disease having taken place upon a farm of Mr. Muskett, of Narford, the gentleman, who vaccinated sheep from a bottle, went there and vaccinated Mr. Muskett's sheep, but the disease went on unchecked notwithstanding, and four hundred ewes were lost out of a flock of a thousand.

I return to the case of Mr. Overman's sheep. Mr. Overman sent

two sheep, after being pressed to do so, to the farm of a neighbour, in whose flock the small-pox existed; and these two sheep were inoculated on that farm; one of them by Mr. Cooke, of Litcham—a farmer who, I do not hesitate to say, at that time performed the operation far better than many so-called veterinary practitioners—and the other by Mr. Baldwin, a veterinary surgeon of Fakenham. Both sheep took the disease, and passed through its several stages; the result being in no way different from that which is observed in hundreds of other sheep that are unprotected. Mr. Overman, however, denied that these sheep did take the disease. Subsequently I proposed to Mr. Overman, that he should send five lambs to this farm where they would be exposed to the disease; and five other lambs to the Veterinary College; himself selecting his most successful cases of vaccination. This arrangement, although agreed to at first on his part, was not carried out. On the same farm to which the two sheep, inoculated the one by Mr. Cook, the other by Mr. Baldwin, had been sent, the gentleman who had vaccinated (?) sheep for Mr. Overman, Mr. Hudson, and others, was asked, not to vaccinate, but to inoculate the sheep. I do not know how he proceeded, but three weeks after his inoculation of the sheep, I myself saw the animals, and found many of them in the earlier stages of the disease; whereas, if they had been properly inoculated, they would have been in the third stage, and recovering.\* The circumstance of these sheep having the *natural* disease at that time, was communicated to Mr. Overman, who made it the ground of his objecting to carry out his agreement with me.

There were, however, a few sheep properly vaccinated in Norfolk; some by Mr. Rose, a surgeon; seven or eight by Mr. Joy, another surgeon; and also some by a veterinary surgeon, Mr. Smith, of Norwich. In these cases proper lymph was used, and every care taken; and the unanimous opinion of these gentlemen was, that vaccination was of no avail, because it was found that both by exposure and by inoculation the vaccinated sheep took the small pox. The number of sheep really vaccinated in Norfolk in 1848, was only about five-and-thirty—not three or four thousand, as some persons have stated—and as I have just shown in the instances in which it was tried, it did not protect the animals against the natural infection.

I now come to the proceedings of Mr. Ramsay, surgeon, of Shelford, Cambridgeshire, who wrote to the 'Times,' in 1848, setting forth the great value of vaccination; and again in 1862 to the 'Standard,' which letter afterwards appeared in other newspapers. He says, in his communication to the 'Standard,' that in 1848 he vaccinated a large number of sheep for Mr. Jonas Webb, Mr. Samuel Jonas, Mr. Hurrell, and other gentlemen in his locality; and he leads his readers to infer that these sheep were perfectly protected against the infection of sheep-pox, and that vaccination, therefore, ought to be had recourse to in order to stay the progress of the pest in Wiltshire. Mr. Ramsay was backed up in this statement by Mr. Sprague, surgeon,

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\* The whole of these facts are stated at length in the Report to the Government, which has been sent in by Mr. Marson and myself.



of Kimbolton, Huntingdonshire, who in 1848 was his assistant, and who also wrote a letter, in 1862, to the public papers in support of the view which Mr. Ramsay had promulgated. Mr. Ramsay assumed that the reason why his vaccination succeeded was, that he had recourse to what in technical language is called retro-vaccination; that is to say, he vaccinated a cow with vaccine lymph taken from the human subject, and, having obtained the produce of the lymph from the cow, he used it for operating upon sheep. With regard to retro-vaccination, I will only say that the experience of Mr. Cceley, Mr. Marson, and myself, is, that there is rather a loss both in the quantity and the quality of the lymph by retro-vaccination than a gain, and this opinion is supported by all continental authorities of any repute. If you take a quantity of lymph from the arm of a healthy child, and introduce it into a calf—as calves are more susceptible than cows—supposing it takes, you get very little, if any, increase of the material, and no greater activity of it.

In 1848 I proposed to Mr. Ramsay that he should allow some of the sheep which had been vaccinated on this plan to be subjected to the counter-proof of inoculation. Through the intervention of Mr. Ellis, of Triplow, in Cambridgeshire, Mr. Ramsay consented to select two sheep which he had vaccinated himself, and send them to me at the college. He did so, and wrote a letter to the 'Times' in which he stated that he had sent two sheep to be tested as to the protective power of his vaccination. What was the result? I took one of the sheep and inoculated it with some *old sheep-pox virus* which I had had by me for 16 weeks, during which time it might be supposed to have lost some of its power, and I readily produced the disease from it. The animal went through all the stages of the sheep-pox, and when it arrived at the vesicular stage I took lymph from this sheep and inoculated the other; and with the same result. These two sheep were afterwards sent back to Mr. Ellis, who acknowledged the receipt of them. I wrote to Mr. Ramsay, saying that he was at liberty to test the sheep by any subsequent inoculation, or exposure to the disease, if he thought fit; that they were not protected when they came to London, but were protected now. Yet, in the face of this fact, this gentleman again came before the public as an advocate for the vaccination of sheep in 1862.

I trust that I have said sufficient to show that the agriculturist has been misled to some extent as to the effects of vaccination, and for this reason I think the Government deserves great credit for having determined to test the thing on a large scale. I would epitomise our own experiments by saying that in every instance in which Mr. Marson and myself have been able to produce the vaccine disease in sheep, the animals, when exposed by us to natural small-pox, have taken it; and in every case also in which we have subjected sheep to the counter-proof of inoculation they have taken sheep-pox, and the disease has not been in the least degree mitigated by the previous vaccination. We have also found this very important fact—that whereas Messrs. Ramsay and Sprague speak as if the hundreds of sheep on which they operated were all successfully vaccinated, and as if every sheep was



just as susceptible to the vaccine disease as the human subject—that not more than 35 per cent. of the sheep, in our own experiments, proved to be susceptible to the vaccine disease on a first vaccination.

#### INOCULATION THE ONLY REAL CHECK TO SHEEP-POX.

I do not hesitate to say that when the natural disease appears in a flock, inoculation, properly carried out, is the best and the only sure means of arresting its ravages. It is not to be supposed that in advocating inoculation we neglect separation or segregation, or any other means of abating the severity of the disease, or that we introduce sheep-pox into healthy flocks. We only have recourse to inoculation that we may bring the disorder within bounds, and cut off the supply by which the malady is naturally propagated. One of the good effects of inoculation is that it limits the extension of the disease. All animals that are inoculated will, in the space of about five weeks, especially if they have been dipped in a disinfecting mixture, be in a fit condition to be sold; whereas, if the natural disease went on, it might be five or six months, or even longer, before such would be the case. Nobody indeed could tell when the thing would end.

But some people say that inoculation spreads the disease. In the abstract there can be no doubt that the inoculated disease is infectious; but it is infinitely less infectious than the natural disease, and practically, therefore, sheep-pox as a rule is not spread. Indeed, there is not a single instance in Wiltshire in which the disease can be said to have been spread by inoculation. On the contrary, it was hemmed in and limited to the flocks that became affected in the natural way. The reason why inoculation does not spread the disease is that, as a rule, and particularly when you are dealing with young animals, such as lambs, it gives the disease in a very mild form. Take a hundred lambs, and if inoculation has been properly carried out, not more perhaps, than one in six or seven will be found to have any eruption at all on their bodies. They have the disease, so to speak, locally. But with old animals there is greater fatality.

I have been at some pains to collect information, not only from my own experience, but also from that of others, with reference to inoculation in this country in the outbreak of 1862, as also of that extending from 1847 to 1850, when there were more sheep in one part of Norfolk affected at one time than suffered in Wilts altogether. Thousands of sheep were subjected to inoculation in Norfolk, Suffolk, Essex, Kent, Cambridgeshire, &c., and I feared that the disease would be really naturalised among us, so widely was it then spread, but notwithstanding this, we had not half the hue and cry which was raised about only 3000 sheep being affected in Wiltshire. Taking all the cases of inoculation together, I come to the conclusion that there have not been less than 20,000 sheep inoculated, and that the average mortality has not reached 5 per cent. In some particular flocks the mortality has not been more than 1 to 1½ per cent., and I can show instance upon instance in which it has not exceeded 2 per cent.; but, combining the worst cases with the best, the deaths from inoculation have not attained 5 per

cent. This fact is, I think, quite sufficient to prove, without my entering into further detail, the great value of inoculation, as a means of arresting the progress of small-pox in sheep, if it be properly and rightly carried out. I abstain from mentioning the rules which should be followed with regard to inoculation, because this is a matter which is not well fitted for a meeting like the present, and because I have rather wished to confine myself to the more salient points connected with the important subject of the small-pox of sheep.

The proceedings were brought to a close by a vote of thanks to the Lecturer.

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*Meeting of Weekly Council, Wednesday, June 22nd. Lord FEVERSHAM in the Chair.*

DR. VOELCKER DELIVERED A LECTURE ON THE CHEMICAL QUALITIES OF WATER FOR ECONOMICAL PURPOSES.

Dr. VOELCKER said : An abundance of fresh air, a good supply of pure water, and a sufficiency of wholesome bread, are unquestionably the three greatest material blessings which a kind Providence has supplied for the use of man. Whilst it is universally admitted that we could not live for any length of time without them, it is strange that in actual practice many people appear unconcerned respecting a supply of pure wholesome water. It is admitted in theory to be most necessary for towns as well as for the country ; and yet, when we come to detail, we frequently find people entirely unconcerned respecting the source from which they obtain their water, or the quality of that which they actually use. Thanks to the Sanitary Commission, almost all the large towns are now well supplied with an abundance of good water ; available for all the ordinary domestic purposes. Great care has especially been exercised in providing for the metropolis, but in many country towns, as well as in villages and isolated farm and country houses, the water is often very impure. This can only be attributed to an utter disregard of those properties which are all-important in the supply of our daily wants. It is no doubt for this reason that the Chemical Committee have desired me to give a lecture on the chemical and physical qualities of water intended to be used for ordinary, domestic, and general economic purposes. In my remarks I shall confine myself to those common uses which we ordinarily make of water, without referring to its applications in various other forms, such as ice and steam.

WATER SUPPLY DEFECTIVE IN COUNTRY TOWNS.

I have frequently examined well-waters which I found to be impregnated with an amount of injurious organic matter, and of mineral substances of a questionable character, that surprised me very much. Several of these wells contained nearly three times as much soluble matter as the tank liquid which Mr. Mechi usually applies to his land. Now impurities which are highly injurious to health are highly beneficial in promoting a luxuriant growth of plants ; we thus not

only waste useful manuring matters by allowing substances which ought to go on the land to find their way into our wells, but we contaminate water with poisonous matters, which every now and then manifest themselves in sudden outbreaks of low fever and other disorders. As I have a great objection to speaking in general terms without being able to lay my hand on special cases, I may observe that Cirencester, where I resided for a good many years, affords a very fair illustration of the condition of country towns in this respect. It is naturally a very healthy place, but the drainage is essentially bad, and in some houses and streets the water is so contaminated with injurious substances that people will not reside there, for it is notorious that the localities in which this bad water is found are occasionally visited by fever. This holds good with regard to separate houses, as well as the town itself. When I first went to Cirencester I was anxious to live away from the town. I looked over a certain house, which pleased me in every respect, but some one said to me—"Do not go to that house, even if you can get it rent free, because all the people who have lived there have suffered seriously on account of the unwholesome state of the locality; the water is bad, and the drainage is bad." On examining the water I found it very bad indeed. I ascertained at the same time that the supply came from a surface spring, into which no doubt the drainage of the house, the offices, and the yard, found its way. Well, at first this warning made me hesitate, but the spot was too enticing to be dismissed from my mind without an attempt to remedy the evil. My first step was to stop the supply of water by cutting off the drainage from the house. I walled over the well in the house, and compelled the servants to use water from a deep well in the yard, which was of excellent quality; and I am happy to say that, through this simple means, I succeeded in maintaining my own family in perfect health; so much so that during ten years I did not spend a farthing for medicine.

Now bad water occurs very much more frequently, perhaps, than is generally supposed; at least I infer so from the many samples of water totally unfit for drinking purposes which I have received during the past year. Those who reside in the country, supplying themselves with water where there is no general Board of Health to make provision for their wants, should have a watchful eye to their individual premises. Allow me, then, to point out the properties which we most esteem in water, first for drinking, and then for washing and cooking purposes.

#### WATER FOR DRINKING PURPOSES.

There are four properties which we most esteem in drinking-waters; first, the absence of any putrescent organic matter; secondly, the absence of any discoloration, due either to suspended fine clay, which gives water a muddy appearance, or to dissolved organic matter, such as we find sometimes in peaty districts; thirdly, softness; and fourthly, coolness. It devolves upon me to show how these four properties are intimately connected with the chemical composition of water.

The absence of putrescent organic matter is accounted for in the



case of many waters by the perfect filtration which they undergo in passing through a porous rock or a bed of porous sandy soil. Surface springs invariably contain organic matter in solution, and sometimes if the filtration has been imperfect, a further quantity in suspension. Wherever men or animals congregate refuse matter accumulates, and finds its way into surface wells. An admirable provision is made for the destruction of these matters. Wherever the drainage is good the air which passes along with water through the porous soil almost completely decomposes the organic matter, or at any rate makes it innocuous. We have, then, in the absence of putrescent animal matter, a very good indication that the water is serviceable for drinking.

The presence of a bad smell invariably indicates something wrong in water, though its absence affords no assurance that all is right. Organic matter, however, though always unpleasant is not always injurious. That which occurs invariably in localities where peat abounds in the soil is, I believe, not directly injurious to health, though its presence in water is undesirable, because experience has shown that organic matter of any kind has an injurious effect on the leaden pipes through which water is conveyed to our houses.

It is, then, important to discriminate between the different kinds of organic matter that we are likely to meet with in water; and an excellent method of doing this is to evaporate from a couple of pints to two ounces. If during the evaporation the water becomes coloured it will generally be found that it contains an amount of organic matter which is injurious to health; if it remains colourless, or becomes but slightly coloured, the absence of organic matter of an injurious nature may be safely predicated. If after the water has been perfectly evaporated to dryness, the matter which remains, on being heated, gives off a smell like burnt feathers, which is characteristic of the presence of nitrogenous matters, we have in this at once a proof that the organic matter is of animal origin, and the water should be at once rejected for drinking purposes.

Softness is a quality in water that depends entirely upon its composition. Nowhere in nature do we find water in a perfectly pure state. Even rain-water, which has undergone a kind of natural distillation, contains certain atmospheric impurities which, though useful in an agricultural point of view, are undesirable in drinking-water.

Rain-water is an excellent solvent for many combinations that occur in the soil, acting not only on saline substances like common salt, or on sulphates, such as sulphate of magnesia or sulphate of soda, but also on mineral matters, which are usually regarded in common life as insoluble.

We may instance carbonate of lime, one of the principal constituents of all hard waters. Practically speaking, it is insoluble in pure water, since 25,000 parts of the water are required to dissolve one part of that substance. But we are to remember that rain-water invariably contains carbonic acid in solution, and in virtue of its presence exerts a power of dissolving carbonate of lime with considerable rapidity. It is the carbonic acid in rain-water which accounts for the invariable presence of carbonate of lime in considerable quantities in all spring



and well-water in calcareous districts, where either the chalk formation, or the older limestone rocks prevail. Carbonic acid forms chiefly two combinations with lime. One, which is insoluble, contains one equivalent of lime, and one of carbonic acid; and another, which is soluble, contains two equivalents of carbonic acid to one of lime. It is generally in virtue of the excess of carbonic acid, and the formation of bi-carbonate of lime, that water becomes hard. In speaking of hardness we ought to distinguish between permanent hardness and transient hardness. That which is caused by bi-carbonate of lime is removable to a great extent by boiling, but other mineral matters, such as sulphate of lime, or gypsum, impart to water a permanent hardness, which cannot be removed by simple boiling. Without laying down a definite rule I may state in a general manner that all water which contains more than 16 grains of lime to the gallon may be regarded as truly hard. For an account of the amount of lime contained in the water which is supplied by the different water companies for the use of the metropolis, I may refer you to a very excellent report of Professors Graham, Miller, and Hoffman, which gives detailed analyses of the quantities of lime and other mineral constituents. It there appears that most of the water used in London contains on the average not more than 20 to 25 grains of solid matter in the imperial gallon, and is therefore very serviceable for all ordinary purposes. In supplying water either to a town or to a private house we should endeavour as much as possible to hit upon the sample which, while it is sufficiently pleasant to the taste, is also useful for the kitchen and laundry, for there are hard waters which are excellent for drinking purposes, and yet unfit for cooking and washing. A large amount of carbonate of lime is by no means injurious to the health of man, and we have no evidence that sulphate of lime or gypsum, and other mineral matters that usually occur in drinking-waters, are deleterious. Hence, a water that is very hard, may still be very palatable, and even be preferred for drinking purposes to a softer one which is less sparkling and bright, and more tasteless.

The fourth and last quality that we esteem in water is coolness. Surface waters are invariably cold in winter and warm in summer—a peculiarity which, of course, we do not esteem; whilst water from deep springs has a uniform temperature, being, as compared with the temperature of the air, warm in winter and cold in summer. This uniformity of temperature further indicates a uniformity of composition. The reason of this is, that water of uniform temperature invariably has to descend through a dense mass of rock; and as it trickles slowly through the rock, it becomes saturated thoroughly with whatever it can dissolve; whilst water which finds its way into surface wells is liable to be altered in its composition by purely local circumstances. Thus we occasionally find the waters of surface wells very soft, and containing but very little of any impurity, either organic or mineral, in solution; whilst at other times the very same wells furnish water which is very rich in mineral matters and also contains much organic impurity. This is especially the case in summer; and the

difference is easily accounted for if we take into consideration how water usually collects in our springs. A surface well we can only have when a bed of clay comes near the surface, for this intercepts the surface water. In warm weather little or no water usually collects; and if the water found in a well is tolerably pure, it remains so for some time. During the summer months, however, there are probably accumulations of organic refuse matter around or near the well, and when a heavy fall of rain comes, it flushes them into the well. Hence we find, on examining the water after a heavy fall of rain, that it has a very different composition from that which it had before. Heavy showers of rain do not affect deep wells; and as by filtration through a considerable depth of soil the water is deprived of all injurious contamination, and as deep wells have a uniform temperature, a uniform coolness of water thus becomes an indirect indication of good quality in drinking-water.

In the next place, let me briefly allude to the qualities that we most esteem in

#### WATER FOR COOKING AND WASHING.

Water for washing should be as free as possible from sulphate of lime, which causes hardness, neutralising in a great measure the soap, causing it to curdle, and destroying its detergent properties. It is undesirable to have much lime in water for cooking purposes, because with several organic constituents—for instance, legumin, the albuminous matter in peas and beans—it forms insoluble combinations, so that it is almost impossible to boil peas soft in hard water. Moreover water that contains much lime, on boiling throws down a white deposit, which prevents a proper extract being made from many articles of food, such as meat used to furnish soup, or tea. Very hard waters may be much improved for tea-making by adding a *little* bi-carbonate of soda.

#### MEANS OF RENDERING WATER SOFT.

On a small scale we can effect this by the addition of a little carbonate of soda; but of course on a large scale this is inadmissible. In dealing with waters on a large scale they require to be purified, especially if we intend to make use of them in feeding our steam-boilers, because hard waters are the cause of steam-boiler deposits, which consist principally of carbonate and sulphate of lime. When water is boiled slowly and continuously, as in the steam-boiler, the carbonic acid is driven out, and the bi-carbonate becomes neutral, or insoluble carbonate of lime, which assumes a crystalline form, and accumulates in a stone-like mass at the bottom of the boiler, both injuring the metal, and creating a fearful risk of explosion.

#### CLARKE'S WATER-PURIFYING PROCESS.

Fortunately we have in Dr. Clarke's process a very convenient safeguard. It consists simply in the addition of a certain quantity of lime-water, or even of powdered lime, to hard water. Strange as this remedy may appear at first sight its utility finds a ready explanation in the difference existing between the properties of the neutral or insoluble

carbonate of lime, and of the bi-carbonate or soluble carbonate of lime. Lime-water is simply a solution of quick-lime, or free lime in water; and when this free lime is added to the hard water containing bi-carbonate of lime, it enters into combination with the carbonic acid which previously held the carbonate of lime in solution. The original carbonate of lime, now rendered neutral, and that which is newly formed will then fall down together. This process has stood the test of experience, and answers very well; its only practical inconvenience is, that we have to provide tanks for the deposit which takes place in purifying hard water. But there is a process adopted at Woolwich for keeping boilers clean, which is very preferable to Clarke's purifying process.

#### THE WOOLWICH BOILER-CLEANING PROCESS.

Caustic soda, a material largely manufactured for the use of glass-makers, has the effect of rendering water soft and preventing boiler incrustation. A small quantity (perhaps a half-pound once a-month for a large steam-boiler) suffices for this purpose. Its action very much resembles that of the lime in Clarke's purifying process: the soda takes up the additional quantity of carbonic acid that keeps the carbonate of lime in solution; the neutral carbonate of lime thus formed falls down, and the carbonate of soda remains in solution. It has this additional advantage over Clarke's process that when the water becomes somewhat concentrated by evaporation, the carbonate of soda precipitates the lime from sulphate of lime or gypsum. Having strongly recommended this simple material as affording the best remedy, I may safely pass by all other inferior processes.

#### THE ACTION OF WATER ON LEADEN PIPES.

This subject has caused a good deal of unnecessary alarm. Lead, in the shape of soluble salts, is a highly injurious substance; and, as it is well known that certain waters act upon and dissolve it, fear is frequently entertained that water conveyed by leaden pipes may be contaminated with an amount of lead that will act injuriously upon the health of those who use it for drinking purposes. It is, therefore, a question of some importance to ascertain what the qualities of water are that act upon lead. The records of experience show incontestibly that water containing organic matter acts more rapidly upon lead than that which is free from such matter. From all the experience that is on record this follows incontestibly. In the next place, alkaline constituents (and there are some hard waters which contain a good deal of carbonate of soda or carbonate of potash) act in a special manner on leaden pipes. Hence we possess, in testing the alkalinity of water, at once the means of ascertaining whether or not it is likely to act upon leaden pipes. Even lime acts strongly upon lead. Salts of lime, carbonate and sulphate of lime especially, have, indeed, been considered protecting salts; but I have myself often examined waters which are very rich in carbonate and sulphate of lime, and yet act very strongly upon lead. It is true that soft waters often act upon lead very rapidly; but perhaps not so much by virtue of their softness, as on account of the presence of organic



matter and the absence of carbonic acid, which is a protection against the action of water on lead. In very soft waters we often find very little, sometimes almost a total absence of carbonic acid, and whenever this is the case the water acts upon lead. If you boil water and bring it in contact with clean lead, the latter is acted upon by it. Bright sparkling water, provided it is free from carbonate of soda, does not act upon lead. We have, then, three conditions which will account for the great action that some waters exercise upon lead. The first is, the presence of organic matters; secondly, the presence of alkaline salts or alkalis; and thirdly, the absence of carbonic acid. I would particularly impress upon you that there are soft waters which do not act upon lead, and that there are, on the other hand, hard waters that rapidly act upon lead.

In order to exhibit correctly the action of alkaline substances, I have here a piece of leaden pipe which has been brought into contact simply with mortar, and you will notice how the lime contained in the mortar acts upon the lead in the same way as the carbonate of soda which occurs sometimes in water, causing it to be converted into oxide of lead. The pipe itself has been converted almost entirely into litharge; indeed, it is worn into a thin film or sheet. It appears that all alkaline earths, like lime, have this effect, causing the lead to change rapidly into oxide of lead, which you will observe is an incrustation. I have analysed the sample I have in my hand, and I find it to be nearly pure litharge.

In laying down water-supply pipes, particular care should be taken not to put them in cement, for the lime acts upon the lead, but to surround them with gravel. Pipes are frequently eaten away in consequence of inattention to this point. Leaden tanks and water-cisterns are sometimes rapidly eaten away by the corrosive action of some waters. A very good protection is to throw in a few pieces of zinc, which is more readily attacked than lead: and as long as there is any zinc present the lead is saved from attack. When zinc is so employed the water may be used for feeding steam boilers, but is not to be recommended for drinking purposes. It is fortunate that, even when lead finds its way into the water it is removed by exposure to the air. Air contains carbonic acid, and in contact with carbonic acid the lead which has passed into the water becomes again precipitated. Carbonate of lead is insoluble, and filtration through an ordinary water-filter entirely deprives the water of its lead. The danger, then, of poisoning by lead, or by water containing lead, is very much less than is usually believed. Indeed, I do not think there is a single instance on record in which the presence of lead in water has proved injurious; for at the most only small quantities of lead can find their way into the water, and these again are rapidly and certainly removed by standing and by filtration.

Time does not admit of my making any observations on the qualities of water for irrigation; and there are so many points of practical importance connected with the subject, that perhaps it is as well I should defer that matter for a future occasion.

In the course of a discussion which ensued,

Sir J. JOHNSTONE drew attention to the remark of Dr. Voelcker,



that he did not think any persons had been injured by water taken out of leaden cisterns, and asked whether the Professor gave it as his positive opinion that leaden cisterns would not be subject to decomposition, if a good deal of free carbonic acid were placed in the water.

Dr. VOELCKER replied that it might attack the lead and corrode it; but the presence of carbonic acid was undoubtedly a safeguard.

Mr. FRERE wished to make an observation on the agricultural aspect of the question. Great interest had of late been manifested in the provision of better houses for agricultural labourers. Circumstances in general seemed so to concur, that the same spots upon which labourers were worst housed were also the most unfavourable for a supply of water. These places were frequently dependent upon land springs, which, as the Professor had stated, were most unsatisfactory sources of supply; and he thought that if a day were set apart for the special discussion of that branch of the subject, it would be of advantage to the whole agricultural community, and especially to the farm labourer. They would then require the aid not only of their Professor of Chemistry, but of men familiar with the geological aspects of our various clay strata, and men of practical experience in the making of ponds and reservoirs for retaining the water when supplies had been procured.

It had been suggested to him that zinc was now largely used for tanks in this town. He should like to know what the Professor thought of the use of such tanks.

Dr. VOELCKER said the effect was very similar to that which water exercised on lead, with this difference, that zinc got more easily eaten away by some kinds of water than even lead; he should think the water undesirable for drinking purposes.

A vote of thanks was then passed to Dr. Voelcker, who, in briefly acknowledging the compliment, observed that he could speak with some authority upon one point to which Mr. Frere had alluded. The bad quality of the water with which cottages were generally supplied in agricultural districts was really a hardship that pressed with peculiar severity upon the industrious and thrifty labourer; the man who did not visit the public-house, but stayed at home with his family, cultivated his garden, and kept a pig. Of course, where a pig was kept and a garden cultivated, there would be an accumulation of refuse organic matter which found its way into the surface well. Thus, the industrious man, who ought to be particularly encouraged, was particularly inconvenienced, and it might be, his life and that of his children endangered.

The CHAIRMAN said this was a matter of very great importance. In the parish in which he resided they not long ago brought the water down from a fine spring on the moors, and laid it on for the supply of the houses in the town and of the labourers' cottages. They were not dependent, therefore, upon any well. There was a constant supply of fresh, wholesome water kept up, and the advantage was very great over the surface well.

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## SELECT CLASSIFIED LIST OF AGRICULTURAL PATENTS FOR THE YEAR 1863.

[Compiled from the Commissioners of Patents' Journal.]

IN this list such patents as originated in the year 1862, and were noticed in Vol. XXIV. of this Journal, are distinguished by having an asterisk (\*) prefixed. The figures at the commencement of each item indicate the number of the patent on the official register.

The patents under each head are arranged alphabetically according to the name of the Inventor.

### I. IMPLEMENTS USED IN THE VARIOUS PROCESSES OF CULTIVATION.

#### PLOUGHS.

- 1325. James Buckingham, of Launceston, Cornwall, *Improvements in Ploughs*. Application dated 26th May; provisional protection, 5th June; notice, 6th October, 1863.
- 689. W. E. Gedge (John Gedge and Son), of 11, Wellington-street, Strand, patent agent, *An improved Plough*. (*A communication from abroad by J. G. E. Chamageran, of La Lambertie, Gironde, France.*) Application dated 14th March; provisional protection, 3rd April, 1863.
- 3011. W. E. Gedge (J. Gedge and Son), of 11, Wellington-street, Strand, patent agent, *An improved Plough*. (*A communication from J. A. I. Pharasier, of Puy, France.*) Application dated 1st December; provisional protection, 11th December, 1863.
- \*3325. William Goulding, of Leicester, *Improvements in Ploughs*. Application dated 11th December, 1862; notice, 21st April; patent sealed, 2nd June, 1863.
- 427. Jesse Lee, of Church Gate, Leicester, *Improvements in Ploughs and Harrows*. Application dated 17th February; provisional protection, 27th February, 1863.
- 1372. James Mellard, of Rugeley, Staffordshire, agricultural implement manufacturer, *Improvements in double moulding or ridging ploughs*. Application dated 2nd June; provisional protection, 12th June, 1863.
- 1764. William Roberts, of Lylands Twyford, near Winchester, farmer, *Improvements in Ploughs*. Application dated 14th July; provisional protection, 24th July, 1863.
- \*3376. Leonard Salter, of Leigh, near Tunbridge, Kent, farmer, *Improvements in Ploughs*. Application dated 17th December, 1862; provisional protection, 9th January; notice, 21st April; patent sealed, 12th June, 1863.
- 1839. Joseph Simmons, of Rainham, Sittingbourne, Kent, agricultural implement maker, *Improvements in Ploughs*. Application dated 22nd July; provisional protection, 7th August; notice, 1st December, 1863.

CULTIVATORS, DIGGERS, &c.

- \*2699. T. Beards, of Stowe, Buckingham, *Improvements in machinery for cultivating land.* Application dated 6th October, 1862; patent sealed, 6th April, 1863.
- 1884. J. W. Branford, of March, Cambridgeshire, merchant, *Improvements in apparatus for hoeing and cleaning the land, and for cutting or setting out the plants of root crops at certain distances from each other, and which invention he designates "A longitudinal and transverse hoe."* Application dated 30th July; provisional protection, 21st August; notice, 15th December, 1863.
- \*2501. R. A. Brooman, of 166, Fleet-street, London, patent agent, *Improvements in implements for cultivating the soil.* (*A communication from France.*) Application dated 11th September; provisional protection, 3rd October, 1862; notice, 13th January; patent sealed, 6th March, 1863.
- 2676. O. C. Evans, citizen of America, now resident in Manchester, *Improvements in digging machinery.* Application dated 29th October; provisional protection, 13th November; notice, 8th December, 1863.
- 2129. Charles Harratt, of Hornsey-lane, Highgate, Middlesex, *Improvements in apparatus for tilling land.* Application dated 28th August; provisional protection, 18th September; notice, 20th October; patent sealed 4th December, 1863.
- \*3216. John Irwin, of Wellingborough, Northamptonshire, *An improved machine for cultivating land.* Application dated 1st December; provisional protection, 12th December, 1862; notice, 7th April, patent sealed, 12th May, 1863.
- \*3090. Charles Littleboy, of Straffan, county Kildare, Ireland, land steward, *Improvements in implements for cultivating land.* Application dated 17th November; provisional protection, 5th December, 1862; notice, 10th March; patent sealed, 5th May, 1863.
- 1033. J. P. and E. B. Nunn, of Royston, Cambridgeshire, farmers, *Improvements in hoes and cultivators.* Application dated 25th April; provisional protection, 22nd May; notice, 2nd June; patent sealed, 23rd October, 1863.
- 580. A. F. Pagny, of Paris, gentleman, *A new agricultural implement called "Billon-Roule," for cultivating tubercles, roots, and all oil plants.* Application dated 3rd March; provisional protection, 17th April; notice, 7th July; patent sealed, 29th August, 1863.
- 2948. James Platt, of Gloucester, engineer, *Improvements in machinery and apparatus for cultivating land.* Application dated 23rd November, 1863.
- 545. Michael Puddefoot, of Blisset-street, Greenwich, hat manufacturer, *Improvements in implements for tilling and cultivating land.* Application dated 26th February; provisional protection, 10th March; notice, 7th July, 1863.
- 1404. Joseph Seaman, of Lowesmoor Works, Worcester, agricultural implement manufacturer, *Improvements in implements to be used in the cultivation of the soil.* Application dated 5th June; provisional protection, 26th June; notice, 13th October; patent sealed, 1st December, 1863.
- 2351. William Woofe, of Gloucester, agriculturist, *Improvements in implements for tilling the soil, and in means of drawing ploughs and other*

*implements for tilling through the land.* Application dated 24th September; provisional protection, 9th October, 1863.

#### ENGINES AND APPARATUS FOR STEAM CULTIVATION.

2128. John Alison, of Reigate, Surrey, gentleman, *Improvements in apparatus for tilling land, which improvements are chiefly applicable when steam power is employed.* Application dated 28th August; provisional protection, 11th September; notice, 22nd September; patent sealed, 10th November, 1863.
2513. John Fowler, of Leeds, engineer, *Improvements in apparatus for hauling agricultural implements.* Application dated 13th October; provisional protection, 23rd October, 1863.
1726. R. Hornsby, junr., J. Bonnell, and W. Astbury, all of Spitalgate Iron Works, Grantham, Lincolnshire, *Improvements in traction engines, and in apparatus for ploughing and tilling lands by steam and other power, part of which improvements is also applicable to driving or giving motion to machinery.* Application dated 10th July; provisional protection, 24th July; notice, 4th August; patent sealed, 11th September, 1863.
880. James Howard, E. T. Bousfield, and J. Pinney, of Bedford, engineers, *Improvements in steam engines, and in the means of applying the same to the tilling of land, also in apparatus to be used with such engines in the tilling of land.* Application dated 7th April; provisional protection, 24th April; notice, 28th April; patent sealed, 2nd June, 1863.
1379. Etienne Joseph Jarry, of 29, Boulevard St. Martin, Paris, merchant. *Improvements in machinery to be worked by steam or other power, for clearing and ploughing land.* Application dated 2nd June; provisional protection, 3rd July; patent sealed, 13th November, 1863.
- \*3156. W. H. Samson, of Underhill, Wittersham, Kent, *Improvements in machinery for cultivating land by steam power.* Application dated 27th December, 1862; provisional protection, 9th January, 1863.
688. William Smith, of Little Woolstone, Bucks, farmer, *Improvements in machinery for cultivating land and sowing seed.* Application dated 13th March; provisional protection, 27th March; notice, 31st March; patent sealed, 27th May, 1863.
2614. Frederick Tolhausen, of 17, Faubourg Montmartre, Paris, civil engineer and patent agent, *An improved steam cultivator.* (*A communication from the Marquis Emmanuel de Ponçins, Feurs Loire, France.*) Application dated 25th September; provisional protection, 17th October, 1862; notice, 27th January; patent sealed, 20th March, 1863.
3126. Thomas Webb, of Smallwood Manor, Uttoxeter, Staffordshire, *Improvements in engines for hauling agricultural implements, and also in traction engines.* Application dated 11th December, 1863.\*

#### TRACTION ENGINES, &c.

61. Thomas Aveling, of Rochester, engineer, *Improvements in the construction of traction engines.* Application dated 7th January; provisional protection, 30th January; notice, 5th May; patent sealed, 16th June, 1863.
1377. G. A. Barrett, W. Exall, C. J. Andrews, and A. Barrett, of Reading, engineers, *Improvements in valves and apparatus for regulating*



*steam-engines. (A communication in part from America.)* Application dated 2nd June; patent sealed, 27th November, 1863.

756. George Arthur Biddell, of Ipswich, Suffolk, mechanical engineer, *Improvements in locomotives, usually called "traction engines," to be used on common roads.* Application dated 21st March; provisional protection, 17th April; notice, 19th May; patent sealed, 18th September, 1863.
  1482. Robert Blackburn, of Exeter, engineer, *Improvements in traction engines.* Application dated 13th June; provisional protection, 17th July; notice, 20th October; patent sealed, 12th December, 1863.
  357. David Law and John Downie, of Glasgow, engineers, &c., *Improvements in traction engines or common road locomotives.* Application dated 9th February; provisional protection, 20th February; notice, 9th June; patent sealed, 4th August, 1863.
  1538. Augustin Morel, of Roubaix, France, manufacturer, *Improvements in traction engines.* Application dated 19th June; provisional protection, 3rd July; notice, 27th October; patent sealed, 12th December, 1863.
  - \*2480. Fraser Selby, of Surbiton, Surrey, engineer, *Improvements in traction engines and valves for ditto.* Application dated 9th September, 1862; notice, 20th January; patent sealed, 6th March, 1863.
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- \*3252. James Braddock, of Droylesden, Lancashire, engineer, *Certain improvements in machinery or apparatus for effecting the separation of impurities from the water employed in steam-boilers, and also for effecting the circulation of the said water.* Application dated 4th December, 1862; notice, 3rd March; patent sealed, 2nd June, 1863.
  2808. J. H. Johnson, of 47, Lincoln's Inn Fields, Middlesex, *Improvements in the prevention or removal of incrustation in or from steam-generators. (A communication to him from France.)* Application dated 17th October, 1862; patent sealed, 9th April, 1863.
  - \*2028. Alexander Leslie, of Turiff, Aberdeenshire, N. B., farmer, *Improvements in apparatus for applying steam or other motive power to cultivate the soil and to actuate wheeled carriages.* Application dated 15th July; provisional protection, 25th July; notice, 18th November, 1862; patent sealed, 13th January, 1863.
  896. George Spencer, of No. 2, Lausanne Villas, Queen's-road, Peckham, Surrey, civil engineer, *Improvements in preventing incrustation in steam-engine boilers.* Application dated 6th April; patent sealed, 2nd October, 1863.
  106. C. H. Townsend and Jas. Young, of Bristol, engineers, *Improvements in composition for preventing incrustation and corrosion in steam-boilers and condensers.* Application dated 13th January; provisional protection, 23rd January; notice, 26th May; patent sealed, 10th July, 1863.
  - \*2583. James Wilson, of North Brixton, in the county of Surrey, warehouseman, for an invention of *An improved composition for preventing and removing incrustation in boilers.* Application dated 20th September, 1862; patent sealed 17th March, 1863.

## HARROWS.

2452. C. P. Button, 27, Leadenhall-street, City of London, merchant, *Improvements in harrows. (A communication from W. D. Sperry, of Cleveland, U. S.)* Application dated 7th October; provisional protection, 16th October, 1863.
995. W. C. Cambridge, of Bristol, agricultural implement-maker, *Improvements in the construction of harrows.* Application dated 21st April; provisional protection, 22nd May; notice, 18th August; patent sealed, 2nd October, 1863.
630. Charles Clay, of Walton Grange, Wakefield, *Improvements in chain-harrows.* Application dated 5th March; provisional protection, 20th March; notice, 7th July, 1863.
2391. John Cooper, of Ipswich, agricultural implement-maker, *Improvements in the construction of harrows.* Application dated 29th September; provisional protection, 9th October, 1863.
1672. A. and B. S. Gower, of Market Drayton, Shropshire, agricultural engineers, *An improved sowing and harrowing machine.* Application dated 6th July; provisional protection, 24th July; notice, 13th October; patent sealed, 17th December, 1863.
1827. George Haseltine, 12, Southampton-buildings, Middlesex, civil engineer, *An improved implement for harrowing and smoothing land. (A communication from John Kelsey, of Yardbyville, U. S.)* Application dated 21st July; provisional protection, 7th August; notice, 24th November, 1863.
2752. Robert Sellar, of Huntley, Aberdeenshire, agricultural implement manufacturer, *An improvement in the construction of harrows.* Application dated 6th November; provisional protection, 27th November, 1863.
- \*2803. John Summerton, of Smethwick, Staffordshire, agricultural machinist, *Improvements in harrows for harrowing land.* Application dated 17th October, 1862; notice, 24th February; patent sealed, 14th April, 1863.
83. William Tasker, jun., of Andover, *Improvements in the construction of harrows.* Application dated 9th January; provisional protection, 6th March; notice, 28th April; patent sealed, 16th June, 1863.

## HORSE-RAKES, &amp;C.

- \*2646. Joseph Bucknall, of Boston, Lincolnshire, mechanic, *Improvements in the construction of horse-hoes.* Application dated 30th September, 1862; notice, 13th January; patent sealed, 27th February, 1863.
1368. John Davey, of Craffhole, Cornwall, agricultural implement-manufacturer, *Improvements in horse-rakes.* Application dated 1st June; provisional protection, 12th June, 1863.
1849. T. Perkins, of Hitchin, Herts; ironmonger, *Improvements in horse-rakes and hand-rakes.* Application dated 23rd July; provisional protection, 14th August, 1863.
- \*3318. Isaac Spight, of Glandford Briggs, Lincolnshire, agricultural machine-maker, *Improvements in horse-hoes.* Application dated 11th December, 1862; provisional protection, 2nd January; notice, 24th March; patent sealed, 5th June, 1863.

911. J. Wightman and C. Dening, of Chard, Somerset, agricultural implement-makers, *Improvements in horse-rakes*. Application dated 10th April; provisional protection, 1st May, 1863.
- \*2838. W. J. Williams, of No. 51, Dorset-street, Salisbury-square, Middlesex, *Improvements in the construction of field-rakes for agricultural purposes*. (A communication in part from U. S. America.) Application dated 27th October, 1862; notice, 24th February; patent sealed, 21st April, 1863.

CLOD-CRUSHER.

- \*2364. Joseph and Benjamin Harrison, of Otley, Yorkshire, farmers, *Improvements in clod-crushers*. Application dated 26th August; provisional protection, 19th September, 1862; patent sealed, 20th February, 1863.

SEED AND MANURE DRILLS, DISTRIBUTORS, &C.

1359. John Heard, of Crediton, Devon, *Improvements in apparatus for distributing manure*. Application dated 30th May; provisional protection, 3rd July, 1863.
1698. Thomas Preece, of Leominster, Herefordshire, implement-maker, *An improved corn and seed-drill*. Application dated 8th July; provisional protection, 6th November; notice, 17th November, 1863.
929. Robert Reeves, of Bratton, Wilt., *Improvements in the manufacture of liquid-manure drills*. Application dated 13th April; provisional protection, 1st May; notice, 9th June; patent sealed, 21st July, 1863.
359. Henry and John Smith, of Bury St. Edmunds, Suffolk, implement-makers, *Improvements in drills or machines for depositing seed and manure*. Application dated 9th February; provisional protection, 20th February, 1863.
2861. John Walmsley, of the town of Berlin, province of Canada, farmer, *Improvements in machinery for pulverizing and cleaning the soil, and scattering seed, guano, bone-dust, and other substances thereon*. Application dated 14th November; provisional protection, 27th November, 1863.

MISCELLANEOUS IMPLEMENTS FOR COMBINED OPERATIONS.

1370. Charles Belcher, of Little Coxwell, Berks, farmer, *Improvements in cutting and transplanting turf and in apparatus to be employed therein, which apparatus is also applicable to the extraction of weeds, and to the planting of seeds, roots, sets, or plants*. Application dated 1st June; provisional protection, 12th June; notice, 13th October, 1863.
3223. John Green, of Newtown Farm, in the parish of St. Martin, Worcestershire, agriculturist, *Improvements in the construction of harrows, cultivators, and ploughs*. Application dated 21st December, 1863.
1473. Robert Hughes, of Worcester, road surveyor, *An improved implement or apparatus for scraping and sweeping turnpike and other highways, carriage-drives, and footwalks, or other places requiring to be so cleaned*. Application dated 12th June; provisional protection, 3rd July; notice, 20th October; patent sealed, 8th December, 1863.

807. John King, of Chadshunt Farm, near Kineton, and Thomas Henry Marshall, of Combroke, Warwick, *Improvements in machinery and apparatus for preparing land for seed, and for harrowing, and in fencing land.* Application dated 27th March; provisional protection, 24th July; notice, 28th July; patent sealed, 11th September, 1863.
754. F. and A. Roberts, of Gloucester, *Improvements in agricultural implements, and in apparatus for working the same.* Application dated 21st March; provisional protection, 3rd April; notice, 7th April; patent sealed, 18th September, 1863.

## II. HARVESTING MACHINES, &c.

### MOWING AND REAPING MACHINES.

2212. Louis Adam, of Moscow, Russia, merchant, *An improved machine for mowing grass or reaping grain.* Application dated 8th September, 1863.
874. A. C. Bamlett, of Ripon, Yorkshire, agricultural engineer, *Improvements in reaping and mowing machines.* Application dated 7th April; provisional protection, 17th April; notice, 18th August; patent sealed, 2nd October, 1863.
751. J. Brigham and R. Bickerton, of Berwick-upon-Tweed, implement-makers, *Improvements in reaping or mowing machines.* Application dated 20th March; provisional protection, 22nd May; notice, 28th July; patent sealed, 11th September, 1863.
2339. J. Brigham and R. Bickerton, of Berwick-on-Tweed, implement-makers, *Improvements in reaping or mowing machines.* Application dated 22nd September; provisional protection, 2nd October, 1863.
2695. J. Brigham and R. Bickerton, of Berwick-on-Tweed, implement-makers, *Improvements in reaping and mowing machines.* Application dated 30th October, 1863; provisional protection, 13th November; notice, 24th November, 1863.
1574. C. T. Burgess, of Gower-street, Middlesex, *Improvements in reaping-machines.* Application dated 22nd June; provisional protection, 3rd July; notice, 21st July; patent sealed, 11th September, 1863.
2329. C. T. Burgess, of Upper Gower-street, Middlesex, *Improvements in reaping-machines.* Application dated 21st September; provisional protection, 9th October, 1863.
3095. W. McIntyre Cranston, of No. 77, Upper Thames-street, London, *Improvements in reaping and mowing machines.* (*A communication from William Anson Wood, United States of America.*) Application dated 8th December; provisional protection, 18th December, 1863.
260. Henry Crichley, of Birmingham, ironfounder, *Improvements in reaping and mowing machines.* (*A communication to him from abroad by Robert Bodington, of Melbourne, Australia.*) Application dated 28th January; provisional protection, 6th February; notice, 2nd June; patent sealed, 17th June, 1863.
1001. Theodore Grace, of Bristol, agricultural engineer, *Improvements in reaping and mowing machines.* Application dated 22nd April; provisional protection, 22nd May, 1863.
1984. William Gray, of Brownrigg, Haddingtonshire, N. B., farmer, *Improvements in certain parts of reaping-machines, and in the working*



or application of the same. Application dated 11th August ; provisional protection, 21st August ; notice, 8th December, 1863.

1761. R. Hornsby and J. E. Phillips, of Spittlegate Iron Works, Grantham, *Improvements in reaping and mowing machines.* Application dated 14th July ; provisional protection, 7th August ; notice, 18th August ; patent sealed, 25th September, 1863. .
1503. William Mainwaring, of Banbury, engineer, *Improvements in harvesting-machines.* Application dated 16th June ; provisional protection, 3rd July ; notice, 29th September ; patent sealed, 1st December, 1863.
1188. W. Mattison and G. Barker, of Leeming Bar, near Bedale, Yorkshire, ironfounders, *Improvements in grass-mowing and reaping-machines.* Application dated 12th May ; provisional protection, 22nd May, 1863.
2055. C. H. McCormick, of Chicago, U. S. America, manufacturer, *Improvements in reaping-machines.* Application dated 18th August ; provisional protection, 4th September ; notice, 8th September, 1863.
1090. E. Mitchell, of Fareham, Hampshire, *Improvements in reaping and mowing machines.* Application dated 30th April ; provisional protection, 15th May ; notice, 2nd June ; patent sealed, 10th July, 1863.
78. David Ball Parsons, formerly of New York, U. S., now of 77, Upper Thames-street, London, *Improvements in reaping and mowing machines.* (*A communication in part from abroad.*) Application dated 9th January ; provisional protection, 23rd January, 1863.
598. David Ball Parsons, now of 77, Upper Thames-street, London, *Improvements in reaping and mowing machines.* (*A communication in part from abroad by W. A. Wood, of New York, U. S. America.*) Application dated 3rd March ; provisional protection, 20th March ; notice, 2nd June ; patent sealed, 14th July, 1863.
- \*2218. R. W. Ralph, of Honnington-Grange, near Newport, Salop, *Improvements in reaping-machines.* Application dated 7th August ; notice, 9th December, 1862 ; patent sealed, 30th January, 1863.
21. Robert C. Ransome, of Ipswich, agricultural engineer, *Improvements in reaping-machines.* (*A communication from Warsaw.*) Application dated 2nd January ; notice, 12th May ; patent sealed, 30th June, 1863.
- \*3031. James Shanks, of Abroath, county Forfar, N. B., machinist, *Improvements in mowing-machines.* Application dated 10th November, 1862 ; notice, 17th March ; patent sealed, 5th May, 1863.
810. Reuben Sims (Picksley, Sims, and Co.), Bedford Foundry, Leigh, Lancashire, agricultural implement-makers, *Improvements in reaping and mowing machines.* Application dated 28th March ; provisional protection, 10th April, 1863.
2169. Reuben Sims (Picksley, Sims, and Co.), Bedford Foundry, Leigh, Lancashire, engineer, *Improvements in reaping and mowing machines.* Application dated 2nd September ; provisional protection, 2nd October, 1863.
1248. C. Barnard, J. Bishop, C. Barnard, jun., and G. Barnard, of the Norfolk Iron-Works, Norwich, engineers, *Improvements in lawn-mowing and*

*rolling machines.* Application dated 19th May; provisional protection, 5th June; notice, 9th June; patent sealed, 6th November, 1863.

3092. J. E. Boyd, of Lewisham, Kent, gentleman, *Improvements in lawn mowing and grass-cutting machines.* (Partly a communication from H. Fisher, of Alliance, Ohio, U. S.) Application dated 8th December, 1863.
2397. E. W. Bullard, of Massachusetts, U. S., *A new and useful machine or carriage for turning and spreading hay, and for other useful agricultural purposes.* Application dated 30th September; protection on complete specification, 9th October; patent sealed, 24th November, 1863.
1022. John Cornes and John Coope Davis, both of Ilford, Essex, *Improvements in lawn mowing, rolling, and collecting-machines.* Application dated 24th April; provisional protection, 8th May; notice, 8th September; patent sealed, 23rd October, 1863.
2785. George Ryder and Matthew Gutteridge, of Leicester, *Improvements in haymaking-machines.* Application dated 9th November; provisional protection, 20th November, 1863.
1873. D. Taylor, of Bonchester Bridge, Roxburgh, N. B., joiner, *Improvements in ventilating hay, corn, and other ricks.* Application dated 28th July; provisional protection, 14th August, 1863.

#### THRASHING-MACHINES.

2733. William Audinwood, of Castle Donington, Leicestershire, *Improvements in thrashing-machines.* Application dated 4th November; provisional protection, 27th November, 1863.
1671. G. A. Barrett, W. Exall, C. J. Andrewes, and A. Barrett, of Reading, Berks, engineers, and J. L. Bowhay, of Modbury, Devon, *Improvements in the arrangement and construction of fixed and portable combined thrashing-machines.* Application dated 4th July; provisional protection, 31st July; notice, 10th November; patent sealed, 29th December, 1863.
1058. Henry Beare, of Newton Abbot, Devon, agricultural implement-maker, *Improvements in machines for thrashing out corn from its straw, part of which is applicable for combing the straw.* Application dated 27th April; provisional protection, 8th May; notice, 2nd June; patent sealed, 29th August, 1863.
2033. Edward Hammond Bentall, of Heybridge, near Maldon, Essex, agricultural implement-maker, *Improved machinery for thrashing corn and other grain or seeds.* Application dated 15th August; provisional protection, 4th September; notice, 24th November, 1863.
2921. Thomas Brinsmead, of St. Giles-in-the-Wood, near Torrington, *Improvements in apparatus for thrashing and reeding wheat and other straw.* Application dated 20th November; provisional protection, 11th December, 1863.
270. Nathaniel Clayton and Joseph Shuttleworth, of Stamp End Works Lincoln, *Improvements in thrashing-machines.* Application dated 29th January; provisional protection, 6th February; notice, 17th February; patent sealed, 21st April, 1863.
- \*3212. H. L. Emery, of Albany, U. S., now of 72, Sloane-street, Chelsea, Middlesex, agricultural implement-maker, *Improvements in thrashing-*

- machines.* Application dated 1st December ; provisional protection, 12th December, 1862 ; notice, 14th April ; patent sealed, 27th May, 1863.
2027. F. Flavell, of Welton, near Daventry, in the county of Northamptonshire, machinist, *Improvements in shakers for thrashing-machines.* Application dated 15th August ; provisional protection, 4th September ; notice, 22nd December, 1863.
558. William Gray, of Sheffield, machine-knife manufacturer, *Improvements in the manufacture of beaters for thrashing-machines.* Application dated 27th February ; provisional protection, 20th March ; notice, 26th May ; patent sealed, 30th June, 1863.
1607. J. Head and H. Brinsmead, of Ipswich, Suffolk, *Improvements in machinery applicable to thrashing-machines, and for cutting and bruising straw.* Application dated 25th June ; provisional protection, 31st July, 1863.
1758. James, Thomas, and F. R. Holmes, of Norwich, agricultural engineers, *Improvements in thrashing and dressing machines.* Application dated 14th July ; provisional protection, 24th July ; notice, 18th August ; patent sealed, 23rd October, 1863.
1472. Thomas Hughes Milner, of Edinburgh, N. B., gentleman, *Improvements in thrashing-machines.* (*A communication to him from William Roberts, Melbourne, machine-maker.*) Application dated 12th June ; provisional protection, 3rd July, 1863.
1042. W. E. Newton, of 66, Chancery-lane, Middlesex, civil engineer, *Improvements in thrashing-machines, part of which improvements are also applicable for hulling, decorticating, cleaning, and polishing grains and seeds.* (*A communication from A. Barbier and N. E. Daubrée, both of Clermont, France.*) Application dated 25th April ; provisional protection, 8th May ; notice, 1st September ; patent sealed, 2nd October, 1863.
620. E. P. Plenty and W. Pain, of Newbury, Berkshire, agricultural engineers, *An improved method of supporting screens and straw-shakers, specially applicable to thrashing-machines.* Application dated 6th March ; provisional protection, 27th March, 1863.
1718. William Tasker, junr., of Andover, agricultural engineer, *Improvements in thrashing-machines.* Application dated 9th July ; provisional protection, 24th July ; notice, 17th November, 1863.
- \*2563. Thomas Watts, of Carisbrooke, Isle of Wight, *Improvements in combined thrashing-machines.* Application dated 19th September ; provisional protection, 10th October, 1862 ; notice, 20th January ; patent sealed, 3rd March, 1863.
2272. B. J. Webber, of Newton Abbot, Devon, *Improvements in thrashing-machines.* Application dated 18th September ; provisional protection, 25th September, 1863.
2706. John Wilson, of Upper Poppleton, Yorkshire, *Improvements in thrashing-machines.* Application dated 31st October ; provisional protection, 20th November, 1863.

STRAW AND GRAIN ELEVATORS, &c.

3101. Henry Audinwood, of Weston-upon-Trent, Derbyshire, engineer, *Improvements in raising or removing grain from one place to another.*



Application dated 9th December; provisional protection, 18th December, 1863.

1514. John Bauwell, of Watlington, Oxfordshire, *A combined machine for collecting and placing in rows, or collecting and elevating into a waggon or elsewhere, hay, corn, or other agricultural produce.* Application dated 17th June; provisional protection, 3rd July; notice, 27th October; patent sealed, 17th December, 1863.
923. Charles Atkins Collins, of Trowbridge, Wilts, gentleman, *An improved method and apparatus for loading carts and waggons with hay, straw, and other similar products.* Application dated 11th April; provisional protection, 1st May; notice, 18th August; patent sealed, 2nd October, 1863.
1910. T. Fellowes and H. Hemfrey, of Spalding, Lincolnshire, *Improvements in apparatus for elevating straw and other agricultural produce.* Application dated 1st August; provisional protection, 14th August; notice, 15th December, 1863.
2167. Robert Young, of Glasgow, N. B., millwright, *Improvements in separating and elevating apparatus for grain or granular matters.* Application dated 2nd September; provisional protection, 25th September, 1863.

#### APPARATUS FOR PRESERVING, CLEANING, AND DRYING GRAIN, &c.

822. Wilson Ager, of the City of New York, U. S., engineer, *Improvements in machinery or apparatus for cleaning and decorticating grain.* Application dated 30th March, 1863.
262. Henri Adrien Bonneville, patent agent, Paris, *Improvements in the construction of granaries.* (*A communication from Louis Jean Gustave de Connick, merchant, 24, Rue de Mont Thabor, Paris.*) Application dated 29th January; provisional protection on complete specification, 6th February; notice, 14th April; patent sealed, 19th May, 1863.
2926. H. A. Bonneville, patent agent, 38, Porchester-terrace, Bayswater, *Improvements in preserving grain, flour, and other similar substances, and in the apparatus connected therewith.* (*A communication from Alphonse Louvel, M.D., of Saint Denis, near Paris.*) Application dated 20th November; protection on complete specification, 27th November; notice, 15th December, 1863.
1367. L. S. Chichester, of Brooklyn, New York, U. S., *Improvements in means for drying grain.* Application dated 1st June; provisional protection, 3rd July; notice, 7th July; patent sealed, 23rd October, 1863.
191. Nathaniel Clayton and Joseph Shuttleworth, of Lincoln, *Improvements in rotatory screens suitable for screening wheat and other grain or seed.* Application dated 21st January; provisional protection, 13th February; patent sealed, 21st April, 1863.
857. J. Prosper Hanrez, of Marchiennes au Pont, Belgium, *Improved machinery or apparatus for drying and cooling grain and other substances.* Application dated 4th April; provisional protection, 1st May; notice, 11th August; patent sealed, 25th September, 1863.
737. H. O. Haughton, of Liverpool, *Improvements in machinery for drying and cooling grain and seeds.* (*A communication from abroad by J. B. Wheeler and S. Losee, both of New York, U. S.*) Application



dated 19th March; provisional protection, 31st July; notice, 4th August; patent sealed, 11th September, 1863.

876. John Henry Johnson, of 47, Lincoln's Inn Fields, Middlesex, gentleman, *Improvements in machinery or apparatus for drying grain, applicable also to the manufacture of malt.* (*A communication from Canada.*) Application dated 7th April; provisional protection, 24th April, 1863.
1066. J. H. Johnson, of Lincoln's Inn Fields, *Improvements in drying and cooling grain, and in the machinery or apparatus employed therein.* (*A communication from W. H. Sutton and J. J. Gibson, both of Brantford, county of Brant, Canada, dated 28th April, 1863.*) Application dated 28th April; provisional protection, 15th May; notice, 4th August; patent sealed, 11th September, 1863.
135. L. P. Josse, of Paris, gentleman, *Improvements in apparatus for cleansing wheat, or other grain or seeds.* Application dated 15th January; provisional protection, 30th January; notice, 26th May; patent sealed, 3rd July, 1863.
2534. F. A. E. G. de Massas, of Hoxton, Middlesex, civil engineer, *Improvements in smut-machines, and in machines for cleansing and peeling grain and seeds.* Application dated 16th October; provisional protection, 30th October, 1863.
- \*2959. William Edward Newton, of 66, Chancery-lane, Middlesex, civil engineer, *Improved apparatus for drying grain and other substances.* (*A communication from P. C. Schuyler, of New York City.*) Application dated 1st November, 1862; patent sealed, 13th April 1863.
1226. John Patterson, of Beverley, Yorkshire, engineer, *Improvements in machinery or apparatus for grinding, crushing, cleaning, and hulling or shelling various kinds of farm or vegetable produce, also applicable to the crushing or grinding of minerals and other substances.* Application dated 15th May; provisional protection, 5th June; notice, 22nd September; patent sealed, 10th November, 1863.
699. James Walworth, of Bradford, Yorkshire, corn-mill machine maker, *Improvements in machinery or apparatus for washing or cleansing and drying Egyptian wheat, beans, and other kinds of grain or seeds.* Application dated 14th March; provisional protection, 3rd April; notice, 21st July; patent sealed, 10th September, 1863.
971. Bernard James Webber, of Newton Abbott, Devon, engineer, *Improvements in apparatus for separating corn from the ears, and for combing straw.* Application dated 17th April; provisional protection, 22nd May; notice, 18th August; patent sealed, 25th September, 1863.
2602. John Weems, of Johnstone, Renfrew, North Britain, engineer, *Improvements in machinery, apparatus, or means for drying, cleaning, and cooling grain and other vegetable products.* Application dated 22nd October; provisional protection, 13th November, 1863.
727. Benjamin Wren, of Stockton-upon-Tees, Durham, corn-miller, *Improvements in cleansing and treating certain descriptions of wheat and other grain.* Application dated 18th March; provisional protection, 17th April; notice, 21st July; patent sealed, 11th September, 1863.

## MEASURING AND WEIGHING APPARATUS.

1216. L. S. Chichester, of Brooklyn, U. S., *Improvements in machinery for weighing grain.* Application dated 14th May; patent sealed, 4th August, 1863.
- \*2088. Thomas King, of Truman's Brewery, Spitalfields, Middlesex, *Improvements in apparatus for measuring malt, grain, and other granular substances.* Application dated 22nd July; provisional protection, 1st August; notice, 25th November, 1862; patent sealed, 13th January, 1863.

## CARTS AND OTHER VEHICLES.

1106. J. B. Dubreuil, of Paris, gentleman, *Improvements in carts, waggons, and other vehicles.* Application dated 2nd May; provisional protection, 15th May; notice, 11th August, 1863.
- \*2278. J. H. Johnson, of 47, Lincoln's Inn Fields, Middlesex, gentleman, *Improvements in carts and other vehicles.* (*A communication from France.*) Application dated 13th August; provisional protection, 22nd August, 1862; patent sealed, 21st January, 1863.

## HORSE-POWER MACHINES.

2809. George Haseltine, of 12, Southampton-buildings, civil engineer, *Improvements in endless chain horse-powers.* (*A communication from S. Perry, of Newport, U. S. America.*) Application dated 11th November; provisional protection, 20th November, 1863.
1701. George Haseltine, 12, Southampton-buildings, Chancery-lane, *Improvements in lever horse-power machines, the cog-gearing employed being applicable to other machines.* (*A communication from Cyrus Avery, of Philadelphia, Pennsylvania, U. S.*) Complete specification, 8th July; protection granted, 17th July; notice, 21st July; patent sealed, 2nd October, 1863.

III. FARM, STABLE, DAIRY, GARDEN, AND OTHER  
IMPLEMENTS, PROCESSES, &c.

## CHAFF-CUTTERS, &amp;c.

- \*2160. Benjamin Bailey, of Leicester, machinist, *Improvements in apparatus for cutting chaff, &c., which are also applicable to mowing short or lawn grass.* Application dated 30th July; provisional protection, 8th August; notice, 2nd December, 1862; patent sealed, 21st January, 1863.
2730. Abram Gillett, of Highway Farm, Berks, engineer, *Improvements in machines for cutting chaff and such like substances.* Application dated 4th November; provisional protection, 20th November, 1863.
2993. Thomas Lane, of Cirencester, Gloucestershire, implement-maker, *Improvements in chaff-cutting machinery.* Application dated 28th November; provisional protection, 11th December, 1863.
927. Robert Leggett, engineer, and Robert Gittus, farmer, both of Mildenhall, Suffolk, *Improvements in the construction of machinery or apparatus for cutting chaff and other agricultural produce.* Application dated 13th April; provisional protection, 1st May; notice, 16th June; patent sealed, 2nd October.

518. Robert Maynard, of Whittlesford, Cambridgeshire, *Improvements in portable chaff-cutting machines*. Application dated 27th February; provisional protection, 20th March; notice, 9th June; patent sealed, 28th July, 1863.
2199. Nathan Singleton, of Manchester, commission agent, *Certain improvements in machinery or apparatus for cutting hay, straw, or other similar agricultural produce*. (*A communication from Heinrich Pollack, of Hamburg.*) Application dated 7th September; provisional protection, 25th September, 1863.

CUTTING AND PULPING MACHINES.

120. George A. Biddell, of Ipswich, mechanical engineer, *Improvements in machines for pulping turnips and other vegetable substances*. Application dated 14th January; provisional protection, 23rd January; notice, 19th May; patent sealed, 23rd June, 1863.
- \*3259. Richard Hornsby, junior, of Grantham, Lincolnshire, *Improvements in apparatus for cutting and pulping turnips and other vegetables*. Application dated 4th December, 1862; patent sealed, 27th February, 1863.
1561. Joseph Sainty, Burnham Market, Norfolk, agricultural implement-maker, *Improvements in turnip-cutters for cutting the last slice*. Application dated 22nd June; provisional protection, 21st July, 1863.
3234. John Sainty, of Burnham Market, Norfolk, agricultural implement-manufacturer, *An improved turnip-cutter for cutting the last slice*. Application dated 22nd September, 1863.
2124. John Shaw, of New Wortley, Leeds, implement-maker, *Improvements in machines for cutting or reducing turnips or other roots as food for animals*. Application dated 28th August; provisional protection, 11th September; notice, 22nd September, 1863.
- \*2374. Reuben Sims (Picksley, Sims, and Company), the Bedford Foundry, Leigh, Lancashire, agricultural implement-makers, *Improvements in machinery or apparatus for pulping, stripping, or slicing turnips and other vegetable substances*. Application dated 27th August, 1862; patent sealed, 20th February, 1863.
- \*3026. John Whittaker, of Leigh, Lancashire, agricultural implement-maker, *Improvements in machinery or apparatus for pulping, stripping, and slicing edible roots for cattle*. Application dated 10th November, 1862; notice, 17th March; patent sealed, 5th May, 1863.

APPARATUS FOR SEPARATING AND SIZING ROOTS.

1130. S. Hibbert, J. Lawton, and J. Kay, of Manchester, *Certain improvements in apparatus for cleansing potatoes and in decorticating the same and other esculent roots*. Application dated 6th May; provisional protection, 15th May; notice, 1st September; patent sealed, 2nd November, 1863.
480. Herbert Mackinder, of Mere Hall, Lincoln, for an invention of *Improvements in apparatus for separating potatoes into different sizes*. Application dated 21st February; provisional protection, 6th March; notice, 16th June; patent sealed, 21st July, 1863.
724. Francis Richmond, Henry Chandler, and James Gadsby Richmond, of Salford, Lancashire, agricultural implement-makers, *Improvements*

*in machinery for washing potatoes and other vegetables.* Application dated 18th March ; provisional protection, 27th March ; notice, 21st July ; patent sealed, 11th September, 1863.

2471. John Spencer, of Doncaster, Yorkshire, manufacturer, *Improvements in machinery for separating different sizes of roots.* Application dated 8th October ; provisional protection, 23rd October, 1863.

#### DAIRY UTENSILS, &c.

1082. Margaret Barland, of Mount-street, Grosvenor-square, and E. H. C. Monckton, of the Cavendish Club, *Improvements in apparatus for withdrawing milk from cows and other mammifera, and for conducting it when withdrawn to appropriate receivers.* (*A communication in part from U. S. America.*) Application dated 29th April ; provisional protection, 15th May ; notice, 8th September ; patent sealed, 23rd October, 1863.
1688. W. E. Gedge (Gedge and Son), 11, Wellington-street, Strand, patent agent, *Improved apparatus for milking.* (*A communication from L. Grasset, of Paris.*) Application dated 7th July ; provisional protection, 24th July ; notice, 17th November, 1863.
159. John Laurie, of Manchester, agricultural implement-maker, *Improvements in apparatus for churning milk and mixing liquid compounds.* Application dated 19th January ; provisional protection, 30th January, 1863.
1660. L. Lelios, of Threadneedle-street, London, *Improvements in apparatus for churning.* Application dated 7th July ; provisional protection, 24th July, 1863.
275. John Sainty, of Burnham, Norfolk, agricultural implement-manufacturer, *Improvements in feeding-troughs for sheep and other cattle.* Application dated 29th January ; provisional protection, 20th February, 1863.
1876. John Sainty, of Burnham Market, Norfolk, agricultural engineer, *Improvements in the construction of feeding-troughs for sheep and other cattle.* Application dated 29th July ; provisional protection, 7th August, 1863.
2011. Edward Taylor, of Salford, Lancashire, machinist, *Improvements in apparatus for churning.* Application dated 14th August ; provisional protection, 4th September, 1863.
- \*2686. Francis Watkins, of Smethwick, Staffordshire, *Improvements in apparatus for milking cows.* Application dated 4th October, 1862 ; notice, 10th February ; patent sealed, 27th March, 1863.

#### CURING PROCESSES.

2338. Richard Archibald Brooman, of 166, Fleet-street, London, patent agent, *Certain compositions for preserving cheese.* (*A communication to him from Jean Neuenschwander, of Paris.*) Application dated 22nd September ; provisional protection, 9th October, 1863.
- \*2194. A. and E. M. Denny, of Waterford, Ireland, merchants, *Improvements in the manufacture of bacon.* Application dated 4th August, 1862 ; patent sealed, 30th January, 1863.
127. Henry Turner, of Leeds, *Invention of a process or mode of preventing and curing blight, decay, &c., in potatoes, &c.* Application dated 15th January ; provisional protection, 24th April, 1863.



SEED AND CAKE CRUSHERS.

456. Jean Joseph Badart, Bishopsgate-street, London, *Improvements in the preparation of cotton-seed cake.* Application dated 19th February; provisional protection, 6th March; patent sealed, 5th May, 1863.
1093. Joseph Badart, 9, Bishopsgate-street, London, for an invention of *Improvements in the preparation of rapeseed-cake, linseed-cake, &c.* Application dated 1st May; provisional protection, 22nd May; notice, 2nd June; patent sealed, 14th July, 1863.
- \*2927. Francis Gregory, of Manchester, agricultural machinist, *Improvements in presses for pressing seeds, fruits, hops, and other substances.* Application dated 31st October, 1862; notice, 10th March; patent sealed, 24th April, 1863.
2857. James Harrison, of Kingston-upon-Hull, seed-crusher, *Improvements in mills for cleaning cotton-seed.* Application dated 14th November, provisional protection, 11th December, 1863.
1244. Benjamin Hebblewhite, of Kingston-upon-Hull, draper, *Improvements in machinery or mills for crushing or reducing oilcake, seeds, and other substances.* (A communication from Samuel Hebblewhite, of Sydney, N. S. Wales.) Application dated 18th May; provisional protection, 5th June, 1863.

MALT-MAKING MACHINERY.

1539. Joseph Watts, of Coventry, *Improvements in machinery or apparatus for the manufacture of malt.* Application dated 19th June; provisional protection, 17th July; patent sealed, 18th November, 1863.

STABLE FITTINGS, HARNESS, APPLIANCES FOR HORSE MANAGEMENT, &c.

2091. Henry Balt, of Kentish Town, *Improvements in the roughing of horses by the application of an iron clog, instead of taking off the shoe.* Application dated 20th August; provisional protection, 2nd October; notice, 8th December, 1863.
1685. George Bartholomew, Linlithgow, N. B., edge-tool maker, *Improvements in shoes for the feet of horses and other animals, and in the means of connecting them.* Application dated 7th July; provisional protection, 7th August; notice, 10th November, 1863.
462. Charles Billingsley, of Manchester, saddler, *Improvements in saddlery, harness, driving-straps, and similar articles.* Application dated 23rd February; provisional protection, 6th March; notice, 23rd June; patent sealed, 15th August, 1863.
1375. G. H. Cottam, of the St. Pancras Iron-Works, Old St. Pancras Road, Middlesex, *Improvements in saddle-brackets and in bricks suitable for being used for paving stables and other places.* Application dated 2nd June; provisional protection, 24th July; notice, 28th July; patent sealed, 27th November, 1863.
1852. Abraham English, of Hatfield, Herts, inspector of police, *Improvements in apparatus for securing and protecting horses and other cattle during their transit by rail and other ways, and on board ship.* Application dated 24th July; provisional protection, 7th August; notice, 1st December, 1863.
3041. John Green, of Greenwich, veterinary surgeon, *Improvements in horse-shoes.* Application dated 3rd December; provisional protection, 25th December, 1863.

1807. F. J. Mavor, of Park-street, Middlesex, veterinary surgeon, *Improvements in horse-shoes*. Application dated 11th July; provisional protection, 7th August; notice, 15th September; patent sealed, 16th October, 1863.
1534. S. Middleton, of Newtown Cottage, Hants, near Newbury, Berks, mechanic, *Improvements in iron or other metal shoes, and in the method of securing the same to the hoofs of horses and other animals, without nails*. Application dated 19th June; provisional protection, 10th July, 1863.
730. Frederick Norrington, of Tavistock, Devon, *Improvements in girths or bands and knee-caps for horses*. Application dated 18th March; provisional protection, 27th March; notice, 7th July; patent sealed, 1st September, 1863.
1756. Carl Opperman, of Peckham, Surrey, chronometer manufacturer, *Improvements in means or apparatus to facilitate the connecting and disconnecting horses and other animals with carriages*. Application dated 14th July; provisional protection, 24th July, 1863.
- \*2692. Robert Page, of Great Yarmouth, Norfolk, builder, *Improvements in stables and stabling, applicable in part to kennels and to the floors of fish-houses*. Application dated 6th October, 1862; patent sealed, 7th March, 1863.
1378. Thomas Page, of Adelphi-terrace, Middlesex, civil engineer, *Improvements in shoeing horses*. Application dated 2nd June; provisional protection, 12th June, 1863.
1600. Thomas Page, of Adelphi-terrace, Middlesex, *Improvements in horse-shoes and their fastenings*. Application dated 25th June; notice, 3rd November; patent sealed, 21st December, 1863.
- \*2794. H. A. Rémière, of 52, Rue de l'Arbre-sec, Paris, harness-maker, *An improved horse-collar*. Application dated 16th October, 1862; patent sealed, 3rd March, 1863.
419. Hugh Smith, of 3, Regent's Park-terrace, Gloucester Gate, Middlesex, *Improvements in apparatus for feeding horses*. Application dated 16th February; provisional protection, 27th February, 1863.
3061. F. J. Walthew, of Surbiton, Surrey, Esquire, *Improvements in apparatus for sustaining and lifting draught-horses, to prevent them falling or injuring the vehicle to which they are attached*. Application dated 5th December; provisional protection, 25th December, 1863.
621. William Wells, of Ryder's Court, Leicester-square, Middlesex, *Improvements in horse-shoes and in the method of fastening the same*. Application dated 5th March; provisional protection, 20th March, 1863.

#### BRICK AND TILE MACHINES.

- \*2973. R. A. Brooman, of No. 166, Fleet-street, London, patent agent, *Improvements in machinery for moulding and compressing artificial fuel, peat, bricks, tiles, and other substances*. (*A communication to him from abroad by Jean Baptiste Defrasne, of Paris.*) Application dated 3rd November, 1862; notice, 10th March; patent sealed, 28th April, 1863.
506. D. B. Chatterton, of Chester, mechanical engineer, *Improved brick-making machinery*. Application dated 24th February; provisional protection, 6th March, 1863.

3199. Henry Clayton, of the Atlas Works, Upper Park-place, Dorset-square, *Improvements in machinery for manufacturing bricks.* Application dated 18th December, 1863.
789. George Cowdery, of Llanymynech, Salop, civil engineer, *Improvements in machinery for making bricks.* Application dated 26th March; provisional protection, 1st May; notice, 16th June; patent sealed, 18th September, 1863.
647. James Cowley, of Oxford, engineer, *Improvements in machinery or apparatus for manufacturing bricks, tiles, pipes, and mouldings.* Application dated 9th March; provisional protection, 3rd April; notice, 7th July; patent sealed, 29th August, 1863.
49. Julius G. Dahlke, of Battersea, Surrey, *Improvements in machinery for cutting clay in the manufacture of bricks, tiles, &c. (A communication from Germany.)* Application dated 6th January; provisional protection, 23rd January; notice, 19th May; patent sealed, 3rd July, 1863.
- \*3303. Peter Effertz, of Manchester, engineer, *Improvements in machinery or apparatus for making bricks, tiles, drain-pipes, and other similar articles.* Application dated 9th December, 1862; notice, 21st April; patent sealed, 2nd June, 1863.
2335. Peter Effertz, of Manchester, engineer, *Improvements in machinery or apparatus for making bricks, tiles, pipes, and other similar articles.* Application dated 22nd September; provisional protection, 2nd October, 1863.
1692. George Haseltine, 12, Southampton-buildings, Chancery-lane, *Improvements in brick-machines. (A communication from J. Gregg, of Philadelphia, U. S.)* Application dated 8th July; provisional protection, 24th July; notice, 13th October; patent sealed, 20th November, 1863.
- \*2696. Samuel Holland, of Oldbury, Worcestershire, machinist, *Improvements in machinery for the manufacture of bricks, drain, sanitary, and other pipes, tiles, quarries, and other articles of like manufacture made from clay, marl, and other plastic substances.* Application dated 6th October; provisional protection, 17th October, 1862; notice, 10th February; patent sealed, 27th March, 1863.
2166. Joseph Lewis, of Manchester, engineer, *Certain improvements in machinery or apparatus for preparing and drying clay, and also in machinery to be employed in the manufacture of bricks and tiles.* Application dated 2nd September; provisional protection, 11th September, 1863.
- \*3166. William Longley, of Leeds, builder, *Improvements in machinery for making bricks.* Application dated 25th November, 1862; notice, 24th February; patent sealed, 7th April, 1863.
- \*2450. John Platt, of Oldham, and William Richardson, of the same place, engineers, *Improvements in the preparation of clay for the manufacture of bricks, tiles, &c.* Application dated 4th September; provisional protection, 26th December, 1862; notice, 13th January; patent sealed, 27th February, 1863.
- \*2447. John Platt and William Richardson, of Oldham, Lancashire, mechanical engineers, *Improvements applicable to the burning of bricks, tiles, and other articles of earthenware.* Application dated 4th September, 1862; provisional protection, 26th December; patent sealed, 24th February, 1863.



3145. J. Platt and W. Richardson, of Oldham, Lancashire, mechanical engineers, *Improvements in the preparation of clay for the manufacture of bricks, tiles, and other articles which may be made of such material.* Application dated 12th December, 1863.
- \*3116. Charles Stevens (Stevens and Henderson), of 31, Charing-Cross, patent agent, *An improved brick-making machine.* (*A communication by Alois Milch, of Paris.*) Application dated 20th November; provisional protection, 28th November, 1862; notice, 31st March; patent sealed, 15th May, 1863.

## MANUFACTURE OF PEAT.

597. Theodor Erich, of 77, Newgate-street, London, *Improvements in machinery for pressing peat.* (*A communication from Christian Augustus Erich, of Munich.*) Application dated 3rd March; provisional protection, 20th March, 1863.
2163. Theodor Erich, of Newgate-street, London, *Improvements in machinery for pressing peat.* (*A communication from C. E. Erich, of Munich.*) Application dated 1st September; provisional protection, 18th September, 1863.
528. Thomas Vincent Lee, of 6, Bank-chambers, Lothbury, civil engineer, *Improvements in machinery for digging, compressing, and moulding peat or turf, and for retorts and kilns for drying peat or turf, and making peat or turf charcoal through the agency of hydro-caloric or super-heated steam, and for collecting the products of distillation whilst charring the peat or turf.* Application dated 25th February; provisional protection, 13th March; patent sealed, 10th August, 1863.

## WIRE-FENCING, &amp;c.

1311. George Hunt, of Glasgow, patent agent, *Improvements in posts and pillars for fences and gates.* (*A communication from D. Middleton, New Zealand.*) Application dated 25th May; patent sealed, 20th November, 1863.
1720. A. R. Johnston, of Yoxford, Suffolk, gentleman, *Improved portable fence for sheep and cattle pens and other enclosures.* Application dated 10th July; provisional protection, 24th July; notice, 27th October; patent sealed, 29th December, 1863.
1651. John King, of Chadshunt Farm, Kineton, Warwickshire, *Improvements in fencing land and in hanging gates.* Application dated 2nd July; provisional protection, 7th August; notice, 3rd November; patent sealed, 8th December, 1863.
2978. J. A. R. Main, of No. 5, Renfield-street, Glasgow, gentleman, *Improvements in the mode of connecting and sustaining the intersecting bars of iron fences, hurdles, gates, and other analogous structures.* Application dated 27th November, 1863.
1626. Joseph Simpson, of Darlaston, Staffordshire, manufacturer, *Improvements in iron hurdles and fencing.* Application dated 30th June; provisional protection, 10th July, 1863.

## HORTICULTURAL APPLIANCES, &amp;c.

1855. T. C. Bull and T. Morgan, of Wolbley, Herefordshire, *An apparatus for collecting fruit from trees without injury.* Application dated 25th July; provisional protection, 14th August, 1863.



3205. F. W. Collins, of Morris, county of Otsego, State of New York, U. S., *A certain improvement in apparatus for training hops.* Application dated 19th December, 1863.

624. John Miller, of Upwey, near Dorchester, Dorset, gentleman, *Improvements in horticultural buildings and other glazed structures, part of which improvements is also applicable to ventilating other buildings.* Application dated 5th March; provisional protection, 20th March; patent sealed, 29th August, 1863.

METHOD OF WARPING LAND, &C.

1762. William Wood, of Monkhill, near Pontefract, Yorkshire, *Improvements in warping or covering land, bog, or peat, with earth or soil.* Application dated 14th July; provisional protection, 24th July; notice, 6th October; patent sealed, 18th November, 1863.

ARTIFICIAL MANURES, TREATMENT OF SEWAGE, &C.

2208. T. H. Baker, of Tunbridge, Kent, engineer, and G. Friend, of the same place, engineer, *Improvements in treating excrementitious and sewage matters, and in the means or apparatus employed therein.* Application dated 8th September; provisional protection, 25th September, 1863.

2849. George Barker, of Pendleton, Lancashire, merchant, *Improvements in the construction of syphons for taking off liquid sewage, overflow of rivers, and other like purposes.* Application dated 14th November; provisional protection, 27th November, 1863.

2731. J. A. Barral, chemist, and L. A. Cochéry, of Paris, *Certain improvements in the manufacture of manure.* Application dated 4th November; provisional protection, 13th November; notice, 8th December, 1863.—French patent dated 29th October; Belgian patent dated 6th November, 1863, *for fixing fertilising elements in phosphate of lime.*

\*2712. John and Mary Anne Beale, of Maidstone, *Improvements in the preparation or manufacture of manure.* Application dated 7th October, 1862; notice, 17th February; patent sealed, 6th April, 1863.

1118. Edwin Chesshire, of Birmingham, surgeon, *Improvements in apparatus for intercepting the solid portions of the soil of water-closets.* Application dated, 5th May; provisional protection, 15th May; notice, 25th August; patent sealed, 25th September, 1863.

221. W. Clark, of 53, Chancery-lane, engineer and patent agent, *Improvements in syphons applied to draining, irrigation, and other purposes, whereby they self-suspend and resume action according to requirements.* (A communication from François Triballat, of 29, Boulevard St. Martin, Paris, merchant.) Application dated 24th January; provisional protection, 13th February, 1863.

761. W. Clark, of 53, Chancery-lane, engineer and patent agent, *Improvements in the separation or obtaining of ammonia from azoted matters in the preparation of manure.* (A communication to him from abroad, by L. H. Blanchard and Theodore Chateau, of Paris.) Application dated 21st March; patent sealed, 2nd September, 1863.

1362. W. Clark, 53, Chancery-lane, patent agent, *Improvements in the manufacture of manure.* (A communication from A. F. Mosselman, of 29, Boulevard St. Martin, Paris.) Application dated 30th May; provisional protection, 12th June; notice, 22nd September; patent sealed, 10th November, 1863.

- \*2082. Joseph Daniels, of Leigh, Lancashire, *Improvements in artificial manure*. Application dated 22nd July; provisional protection, 1st August; notice, 25th November, 1862; patent sealed, 13th January, 1863.
953. T. Bell Fletcher, M.D., of Birmingham, *Improvements in apparatus for collecting the solid portions of sewage*. Application dated 15th April; notice, 18th August; patent sealed, 2nd October, 1863.
132. John Harrop, of Manchester, analytical chemist, *Improvements in the treatment of organic fecal and urinous matters for the purpose of deodorising the same, and in the preparation of a portable manure therefrom, and in the treatment of ashes or other refuse of combustion to be combined therewith, also for improvements in machinery to be employed in the manufacture of the said manure*. Application dated 15th January; provisional protection, 6th February; notice, 17th March; patent sealed, 10th July, 1863.
321. J. A. Manning, of the Inner Temple, London, *Improvements in the treatment of night-soil and other waste products, and for the manufacture of manure therefrom*. Application dated 4th February; provisional protection, 20th February; patent sealed, 14th July, 1863.
1435. Henry Martin, of Surrey-square, Old Kent-road, land agent, *Improvements in treating and preparing night-soil and sewage with other materials as a manure*. Application dated 9th June; provisional protection, 3rd July, 1863.
3264. John Maynes, of Manchester, engineer, *Improvements in the manufacture of certain descriptions of artificial manure, and in apparatus to be employed therein*. Application dated 24th December, 1863.
606. Thomas Henry Morrell, of Leyland, Lancashire, gentleman, and Joseph Williamson, of Willeross, Gisburn, Yorkshire, gentleman, *Improvements in the purifying of the noxious vapours or gases given off from night-soil or other similar substances during the heating, drying, or evaporating of such substances*. Application dated 4th March; provisional protection, 20th March; notice, 24th March; patent sealed, 29th August, 1863.
- \*3361. J. L. W. Thudichum, M.D., of Kensington, Middlesex, *Improvements in collecting human excreta, and in the apparatus and means employed therein*. Application dated 16th December; provisional protection, 26th December, 1862; notice, 28th April, 1863.
2724. Guillaume Ville, of Paris, Professor at the Museum of Natural History, *Improvements in treating natural phosphates of lime for agricultural purposes*. Application dated 4th November; provisional protection, 20th November, 1863.
- \*3132. Thomas Walker, of Birmingham, engineer, *Improvements in utilizing sewage matters, and in the means or apparatus employed therein, part of which improvements is also applicable to raising and forcing other fluids*. Application dated 21st November, 1862; notice, 17th March, 1863.
3152. John Wright, of Marple, near Stockport, Cheshire, *Improvements in the manufacture of superphosphate of lime*. Application dated 14th December, 1863.

## CONDIMENTAL FOOD.

2050. Alexander Cruickshank, of Glen Park, Lanarkshire, N. B., gentleman, *Improvements in the manufacture or production of food for cattle and*

*all other domestic animals, poultry, and game.* Application dated 18th August; notice, 10th November; patent sealed, 29th December, 1863.

1279. John Fawcett, of Huddersfield, Yorkshire, cattle-food manufacturer, *Improvements in the preparation of food for cattle, horses, and other animals.* Application dated 21st May; provisional protection, 5th June; notice, 6th October; patent sealed, 18th November, 1863.
3174. John Sellars, of Manchester, manufacturing chemist, *An improved preparation of food for cattle.* Application dated 16th December, 1863.
- \*3273. George Wright, of Friern Manor, Peckham Rye, Surrey, *Improvements in the preparation and manufacture of food for cattle.* Application dated 6th December, 1862; notice, 21st April; patent sealed, 2nd June, 1863.

MISCELLANEOUS.

363. Robert Burley, of Glasgow, *Improvements in handles for hammers, mallets, picks, mattocks, and similar tools.* Application dated 10th February; provisional protection, 20th February; patent sealed, 4th August, 1863.
767. William Clark, of 53, Chancery-lane, Middlesex, engineer, *Improvements in agricultural apparatus.* (*A communication from abroad by J. B. Décours, A. C. Le Levandier, and P. E. Lambert, of Paris.*) Application dated 23rd March; provisional protection, 10th April; notice, 30th June; patent sealed, 11th September, 1863.
- \*2106. J. G. Clarke, of Brackley, Northamptonshire, *Improvements in scythes.* Application dated 24th July; provisional protection, 1st August; notice, 2nd December, 1862; patent sealed, 21st January, 1863.
476. R. V. Dodwell, of Manchester, district engineer to the Magnetic Telegraph Company, *An improved method of preventing the destruction of plants by insects and certain descriptions of animals, and in the means for effecting the same.* Application dated 21st February; provisional protection, 6th March, 1863.
716. W. E. Newton, of 66, Chancery-lane, Middlesex, civil engineer, *An improved preparation for the cure of scab, foot-rot, and other diseases of sheep and cattle.* (*A communication from abroad by Patrick Hayes, of Melbourne, in the colony of Victoria, chemical manufacturer.*) Application dated 17th March; provisional protection, 10th April; notice, 14th April; patent sealed, 19th May, 1863.

END OF VOL. XXV.





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1864.

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 HOLLAND, E., M.P.  
 HOSKYN, C. WREN.  
 KINGSCOTE, Col., M.P.  
 LAYCOCK, JOSEPH.  
 MILWARD, RICHARD.  
 NEWCASTLE, Mayor of.  
 PAIN, THOMAS.  
 POPE, EDWARD.  
 RAMSAY, G. H.  
 RANDELL, CHARLES.  
 SHUTTLEWORTH, JOSEPH.  
 THOMPSON, H. S., M.P.  
 TORR, WILLIAM.  
 WILSON, JACOB.

\* \* The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.



## MEMORANDA.

**ADDRESS OF LETTERS.**—The Society's office being situated in the postal district designated by the letter **W**, members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

**GENERAL MEETING** in London, May 23, 1864, at Twelve o'clock.

**MEETING** at Newcastle-upon-Tyne, commencing July 18, 1864.

**GENERAL MEETING** in London, in December, 1864.

**MONTHLY COUNCIL** (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

**WEEKLY COUNCIL** (for practical communications), at 12 o'clock on all Wednesdays in February, March, April, May, June, July, and November, excepting the first Wednesday in each of those months, and during adjournment: open to all Members of the Society, who are particularly invited by the Council to avail themselves of this privilege.

**ADJOURNMENTS.**—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

**DISEASES of Cattle, Sheep, and Pigs.**—Members have the privilege of applying to the Veterinary Committee of the Society; and of sending animals to the Royal Veterinary College, on the same terms as if they were subscribers to the College.—(A statement of these privileges will be found in the present Appendix.)

**CHEMICAL ANALYSIS.**—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in the Appendix of the present volume.

**LOCAL CHEQUES.**—Members are particularly requested not to forward Country Cheques for payment in London; but London Cheques, or Post-office Orders on Vere-street (payable to **H. HALL DARE**), in lieu of them. All Cheques are required to bear upon them a penny draft or receipt stamp, which must be cancelled in each case by the initials of the drawer. They may also conveniently transmit their Subscriptions to the Society, by requesting their Country Bankers to pay (through their London Agents) the amount at the Society's Office (No. 12, Hanover Square, London), between the hours of ten and four, when official récépts, signed by the Secretary, will be given for such payments.

\* **NEW MEMBERS.**—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary.

**PACKETS BY POST.**—Packets not exceeding two feet in length, width, or depth, consisting of written or printed matter (but not containing letters sealed or open), if sent without envelopes, or enclosed in envelopes open at each end, may be forwarded by the inland post, if stamped, at the following rates:—

For a packet not exceeding	4 ounces (or quarter of a pound)	. . .	1 penny
" " "	8 " (or half a pound)	. . .	2 pence.
" " "	16 " (or one pound)	. . .	4 "
" " "	24 " (or one pound and a half)	. . .	6 "
" " "	32 " (or two pounds)	. . .	8 "

[And so on in the proportion of 8 ounces for each additional 2d.]

\* \* Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-Laws, of a Statement of the General Objects, &c., of the Society, of Chemical and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

## Royal Agricultural Society of England.

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### GENERAL MEETING,

12, HANOVER SQUARE, WEDNESDAY, DECEMBER 9, 1863.

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#### REPORT OF THE COUNCIL.

THE Council have to report that since the last General Meeting 317 members have been elected, while 2 Governors and 33 members have died, and 22 members have been removed from the list; so that the Society now consists of—

79 Life Governors,  
87 Annual Governors,  
1,308 Life Members,  
3,952 Annual Members,  
17 Honorary Members,

making a total of 5,443 at the present time; being an increase of 266 within the year.

The finances of the Society are in a satisfactory condition, as is shown by the Balance-sheet to the 30th of June, which has been already published in the 'Journal;' since which time the Finance Committee have reported that all claims against the Society submitted to them up to their last meeting had been discharged. The funded property invested in the names of the Trustees remains at 16,488*l.* 17*s.* 10*d.* stock in the New Three per Cents.

The collection of the arrears of subscription has been steadily progressing; the amount now due, inclusive of those in arrear for the present year, being 631*l.*; and the Council hope that, by an early payment of the subscription, the members will enable them to frame the financial arrangements for the ensuing year.

The period of holding the half-yearly audits having been more closely approximated to the termination of the half-years,

the Council are thus enabled to inform the members, in each successive 'Journal,' as to the latest state of the Society's accounts.

The Worcester Meeting, notwithstanding the unfavourable weather on some days of the Show, fully satisfied the expectations of the Council. The authorities of the city and the Local Committee contributed greatly to promote the objects of the Society on the occasion, and received at the time the public thanks of the members at the General Meeting held in the Town Hall.

The Balance-sheet of the Meeting, which is now laid before the members and will be published in the February 'Journal,' shows that the system of distributing the forage by means of tickets furnished to exhibitors has proved satisfactory, and has tended to reduce this item of expense in the Live Stock Department.

The quadrennial system for the trial of implements, which commenced at Warwick, has terminated this year at Worcester, and, at the request of the Council, the Implement Committee have given the subject their careful consideration. The Council have adopted the recommendation of the Committee, that the trials should, as formerly, be triennial; such special prizes and medals for miscellaneous improvements being also offered each year as the Council may determine. The following is the schedule of arrangement:—

#### SPECIAL PRIZE FOR STEAM-CULTIVATION.

- 1864.—I. IMPLEMENTS AND MACHINERY FOR THE DRAINAGE, TILLAGE, AND CULTIVATION OF LAND.—Tile and brick machines, draining implements, grubbers, ploughs, cultivators, clod-crushers, rollers, harrows.
- 1865.—II. IMPLEMENTS AND MACHINERY FOR THE CULTIVATION AND HARVESTING OF CROPS.—Drills and distributors, horse-hoes, mowing-machines, reaping-machines, haymaking-machines, horse-rakes, carts and waggons.
- 1866.—III.—IMPLEMENTS AND MACHINERY FOR THE PREPARATION OF CROPS FOR MARKET AND FOR FEEDING STOCK.—Steam-engines, thrashing-machines, dressing-machines, mills and crushers, chaff-cutters, cake-breakers, root-cutters and pulpers, dairy implements.

In order to consider the most effectual means of obviating the practice of unfairly clipping sheep for exhibition at the Society's country meetings, the Council appointed a Committee to take

this subject into consideration, and have approved of the following regulations, which they trust will effectually prevent the recurrence of an evil so generally complained of:—

1. That sheep exhibited for any of the prizes must have been *really and fairly shorn bare* after the 1st of April in the year of the exhibition; and that the date of such shearing form part of the certificate of entry.
2. That two inspectors be appointed by the Council, to examine the sheep on their admission to the show-yard, with instructions to report to the Stewards any cases in which the sheep have not been *really and fairly shorn bare*.

The country meeting next year will be held in the week commencing Monday the 18th July, and the authorities at Newcastle-upon-Tyne are making great exertions to place the land for the show-yard and trial-fields in a course of due preparation.

The Council have decided on the prize-sheet for the Newcastle Meeting. That for live stock will amount to 2820*l.*, being an increase over last year of 625*l.*; and for implements the amount will be 550*l.*, being an increase over last year of 240*l.*, making a total increase of 865*l.*

The above will, in addition to the usual prizes, include classes for Channel Islands, Ayrshire, Scotch Horned, and Polled Cattle, Clydesdale Horses, Cheviots, and Black-faced Mountain Sheep.

By Order of the Council,

H. HALL DARE,  
Secretary.



# COUNTRY MEETING ACCOUNT, WORCESTER, 1863.

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## RECEIPTS.

	£.	s.	d.
Subscription from Worcester	1800	0	0
Admissions to Show Yard	5,485	10	9
Sale of Catalogues.	509	10	0
Implement Exhibitors' Payment for Shedding	1,035	19	0
Non-Members' Fees for entry of Implements	49	5	0
Fees for entry of Live-Stock	408	10	0
Fees for Horse Boxes	318	0	0
Fees for Nurse Cows	19	0	0
Fines for non-Exhibition of Live-Stock	31	0	0
Extra lines in Implement Catalogue	25	18	0
Sale of Wheat, Barley, &c.	149	4	0
Sale of Sundries	14	8	0

Excess of Payments over Receipts

	1,243	15	5
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## EXPENDITURE.

Show and Trial Yards, Horse Boxes, hire of Hurdles and Turnstiles	4,382	11	11
*Repairs to Engineering Plant, and Carriage, &c.	86	5	8
Judges: Implements, 21 <i>l.</i> ; Stock, 31 <i>0<i>l.</i></i>	522	0	0
Consulting-Engineer's Assistants	145	10	2
Veterinary-Inspectors and Assistant	64	16	0
Metropolitan Police	136	0	0
Clerks and Assistants: Secretary, 6 <i>0<i>l.</i></i> ; Hon. Director, 35 <i>l.</i> 11 <i>s.</i> 8 <i>d.</i> ; Bankers, 21 <i>l.</i>	116	11	8
Assistant Stewards: Implements, 31 <i>l.</i> 10 <i>s.</i> ; Stock, 25 <i>l.</i> 4 <i>s.</i> ; Forage, 21 <i>l.</i> 1 <i>s.</i>	83	15	0
Foremen of Various Departments	77	10	0
Yardmen and Watchmen, 167 <i>l.</i> 4 <i>s.</i> ; Fieldmen, 13 <i>l.</i> 7 <i>s.</i> 6 <i>d.</i> ; Foragemen, 7 <i>l.</i> 4 <i>s.</i>	187	15	6
Waggoners, 25 <i>l.</i> 15 <i>s.</i> ; Grooms, 11 <i>l.</i> 17 <i>s.</i> 6 <i>d.</i>	40	12	6
Index-Clerk and Money-takers, 71 <i>l.</i> 8 <i>s.</i> ; Door-keepers, Money-changer, &c., } 28 <i>l.</i> 7 <i>s.</i>	99	15	0
Lodgings for Stewards, Implement Judges, Veterinary Inspectors, Engineers, &c.	297	4	0
Refreshments for ditto	112	13	0
Catalogues—Implements, 345 <i>l.</i> 10 <i>s.</i> ; Stock, 109 <i>l.</i> 1 <i>0<i>s.</i></i> ; Awards: Implements, } 5 <i>l.</i> 17 <i>s.</i> ; Stock, 7 <i>0<i>l.</i></i> 14 <i>s.</i> ; Sellers of, 27 <i>l.</i> 6 <i>s.</i> ; Packing-cases, 18 <i>l.</i> 10 <i>s.</i>	577	7	0
Printing—Prize-sheets, Certificates, Admission-Orders Tickets, Railway } Papers, Parchment Labels, Circulars, Programmes, Notices, &c., }	256	17	6
Advertising—Newspapers, 208 <i>l.</i> 1 <i>7<i>s.</i></i> 6 <i>d.</i> ; Railways and Bill Posting, 57 <i>l.</i> 12 <i>s.</i>	206	9	6
Postage and Carriage, 71 <i>l.</i> 12 <i>s.</i> 3 <i>d.</i> ; Stationery, 13 <i>l.</i> 5 <i>s.</i> 7 <i>d.</i>	84	17	10
Wheat and Barley, 290 <i>l.</i> ; Insurance of, 16 <i>s.</i>	290	16	0
Hay, 135 <i>l.</i> 2 <i>s.</i> 6 <i>d.</i> ; Straw, 189 <i>l.</i> 8 <i>s.</i> 8 <i>d.</i> ; Vetches, 204 <i>l.</i> 1 <i>s.</i> 6 <i>d.</i> ; Oats, 11 <i>l.</i> 5 <i>s.</i> 3 <i>d.</i>	539	17	11
Bankers—Commission, 15 <i>l.</i> ; Cab Hire, &c., 7 <i>l.</i> 1 <i>s.</i> 6 <i>d.</i> ; Base Coin, 2 <i>l.</i> 2 <i>s.</i> 4 <i>d.</i>	24	3	10
Surveying	26	3	6
Hire of Fire Engines, 9 <i>l.</i> 9 <i>s.</i> ; Hire of Steam Engines, 7 <i>l.</i> ; use of Driving Belt, } 1 <i>l.</i> 10 <i>s.</i>	17	19	0
Coals, 19 <i>l.</i> 1 <i>s.</i> 2 <i>l.</i> ; Corn and Coal Sacks, 26 <i>l.</i> 10 <i>s.</i> ; Bags and Twine, 3 <i>l.</i> 16 <i>s.</i> 7 <i>d.</i>	49	7	9
Badges	11	12	6
Official Staff—Board, Lodgings, and Travelling Expenses	25	8	6
Sundry Small Bills and Petty Payments	28	16	11
Prizes—Implements, 230 <i>l.</i> ; Stock, 2180 <i>l.</i> ; Medals, 177 <i>l.</i> 2 <i>s.</i>	2,537	2	0
	£11,090	0	2

\* The Sum of 73*l.* for New Dynamometer and Testing Apparatus is not included in this Account, but is charged to the General Funds of the Society.

A. N. HOOD,  
Chairman of Finance Committee.

February 3, 1864.



SOCIETY OF ENGLAND.

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FROM 1ST JULY TO 31ST DECEMBER, 1863.

CR.

By Expenditure:—		£.	s.	d.	£.	s.	d.	£.	s.	d.
Establishment—										
Official Salaries and Wages	..	327	6	0						
House Expenses, Rent, Taxes, &c.		376	8	8						
					703	14	8			
Journal:—										
Printing	.. .. .	602	18	0						
Stitching	.. .. .	72	7	9						
Delivery, Advertising, &c...	.. .. .	163	15	0						
Prize Essays	.. .. .	50	0	0						
Other Contributions	.. .. .	89	15	0						
Editor's Salary	.. .. .	250	0	0						
					1,228	15	9			
Chemical:—										
Consulting Chemist's Salary	.. .. .				150	0	0			
Veterinary:—										
Grant to Royal Veterinary College	.. .. .				100	0	0			
Postage and Carriage	.. .. .				14	2	4			
Advertisements	.. .. .				13	13	6			
Sundries	.. .. .				20	4	7			
Subscription returned (paid in error)	.. .. .				1	0	0			
Dynamometer and Testing Apparatus	.. .. .				73	0	0			
London Show	.. .. .				10	0	0			
								2,314	10	10
By Worcester Meeting	.. .. .							9,604	5	0
Total Payments								11,918	15	10
By Balance in hand:—										
Bankers	.. .. .				443	12	6			
Secretary	.. .. .				17	13	5			
								461	5	11
								£12,380	1	9

31ST DECEMBER, 1863.

ASSETS.		£.	s.	d.
By Cash in hand	.. .. .	461	5	11
By New 3 per cent. Stock 16,488 <i>l.</i> 17 <i>s.</i> 10 <i>d.</i> cost	.. .. .	15,881	11	1
By Books and Furniture, Society's House, Hanover Square	.. ..	2,000	0	0
<i>Mem.</i> —The above Assets are exclusive of the amount recoverable in respect of Subscriptions in arrear 31st December, 1863, which at that date amounted to 574 <i>l.</i>				
		£18,342	17	0

Examined, audited, and found correct, this 10th day of February, 1864.

(Signed)

W. COPELAND ASTBURY.  
HENRY CORBET.

## CR.

QUILTER, BALL, & Co.  
*Accountants.*

[illegible]



**Newcastle-upon-Tyne Meeting, 1864:**  
**IN THE WEEK COMMENCING MONDAY, JULY 18.**

**SCHEDULE OF PRIZES.**

**I.—LIVE-STOCK PRIZES OFFERED BY THE SOCIETY.**

(ALL AGES CALCULATED TO JULY 1ST, 1864).

Reference Number in Certificates.		First Prize.	Second Prize.
<b>CATTLE.</b>			
<b>SHORT-HORNED.</b>			
Class.		£.	£.
1	Bull, above three and not exceeding six years old	25	15
2	Bull, above two and not exceeding three years old	25	15
3	Bull, above one and not exceeding two years old	25	15
4	Bull-Calf, above six and not exceeding twelve months old .. .. .	10	5
5	Cow, above three years old .. .. .	20	10
6	Heifer, in-milk or in-calf, not exceeding three years old .. .. .	15	10
7	Yearling Heifer .. .. .	15	10
8	Heifer-Calf, above six and under twelve months old	10	5
<b>HEREFORD.</b>			
9	Bull, above three and not exceeding six years old	25	15
10	Bull, above two and not exceeding three years old	25	15
11	Bull, above one and not exceeding two years old	25	15
12	Bull-Calf, above six and not exceeding twelve months old .. .. .	10	5
13	Cow, above three years old .. .. .	20	10
14	Heifer, in-milk or in-calf, not exceeding three years old .. .. .	15	10
15	Yearling Heifer .. .. .	15	10
16	Heifer-Calf, above six and under twelve months old	10	5
<b>DEVON.</b>			
17	Bull, above three and not exceeding six years old	25	15
18	Bull, above two and not exceeding three years old	25	15
19	Bull, above one and not exceeding two years old	25	15
20	Bull-Calf, above six and not exceeding twelve months old .. .. .	10	5
21	Cow, above three years old .. .. .	20	10
22	Heifer, in-milk or in-calf, not exceeding three years old .. .. .	15	10
23	Yearling Heifer .. .. .	15	10
24	Heifer-Calf, above six and under twelve months old	10	5

Reference Number in Certificates.		First Prize.	Second Prize.
<b>CATTLE—continued.</b>			
<b>SUSSEX.</b>			
Class.		£.	£.
25	Bull, above one and not exceeding six years old ..	10	5
26	Cow, above three years old .. .. .	10	5
27	Heifer, in-milk or in-calf, not exceeding three years old .. .. .	10	5
28	Yearling Heifer .. .. .	10	5
<b>CHANNEL ISLANDS.</b>			
29	Bull, above one and not exceeding six years old ..	10	5
30	Cow, above three years old .. .. .	10	5
31	Heifer, in-milk or in-calf not exceeding three years old .. .. .	10	5
<b>AYRSHIRE.</b>			
32	Bull, calved before the 1st of January, 1863 ..	20	10
33	Bull, calved after the 1st of January, 1863 ..	20	10
34	Cow, above three years old .. .. .	15	5
35	Heifer, calved before the 1st of January, 1863 ..	10	5
36	Heifer, calved after the 1st of January, 1863 ..	10	5
<b>SCOTCH POLLED (except Galloways).</b>			
37	Bull, calved before the 1st of January, 1863 ..	20	10
38	Bull, calved after the 1st of January, 1863 ..	20	10
39	Cow, above three years old .. .. .	15	5
40	Heifer, calved before the 1st of January, 1863 ..	10	5
41	Heifer calved after the 1st of January, 1863 ..	10	5
<b>SCOTCH HORNED.</b>			
42	Bull, calved before the 1st of January, 1863 ..	20	10
43	Bull, calved after the 1st of January, 1863 ..	20	10
44	Cow, above three years old .. .. .	15	5
45	Heifer, calved before the 1st of January, 1863 ..	10	5
46	Heifer, calved after the 1st of January, 1863 ..	10	5
<b>OTHER ESTABLISHED BREEDS.</b>			
<i>Not including the Short-horn, Hereford, Devon, Sussex, Channel Islands, Ayrshire, Scotch Horned, or Polled Breeds.</i>			
47	Bull, above two and not exceeding six years old	10	5
48	Bull, above one and not exceeding two years old	10	5
49	Cow, above three years old .. .. .	10	5
50	Heifer, in-milk or in-calf, not exceeding three years old .. .. .	10	5
51	Yearling Heifer .. .. .	10	5

Reference Number in Certificates.		First Prize.	Second Prize.
	<b>HORSES.</b>		
Class.		£.	£.
52	For the THOROUGH-BRED STUD-HORSE, having served Mares during the season 1864, which, in the opinion of the Judges, is best calculated to improve and perpetuate the breed of the sound and stout Thorough-Bred Horse for General Stud Purposes .. .. .	100	25
	<b>HUNTER.</b>		
53	Stallion, Thorough-Bred, suitable for getting Hunters, whose regular charge for serving half-bred Mares during the season 1864 has not exceeded Five Guineas .. .. .	25	15
54	Brood Mare, with foal at foot, or in-foal, for breeding Hunters .. .. .	15	10
	<b>HACKNEY.</b>		
55	Brood Mare, with foal at foot, or in-foal, for breeding Hackneys .. .. .	15	10
	<b>PONIES.</b>		
56	Stallion, not exceeding 14 hands .. .. .	15	5
57	Mare, not exceeding 14 hands .. .. .	10	5
	<b>AGRICULTURAL AND DRAY HORSES.</b>		
	<b>AGRICULTURAL.</b>		
	<i>Not qualified to compete as Suffolk or Clydesdale.</i>		
58	Stallion, foaled before the 1st of January, 1862 ..	20	10
59	Stallion, foaled in the year 1862 .. .. .	15	10
60	Mare and Foal .. .. .	20	10
61	Two years old Filly .. .. .	15	10
	<b>DRAY.</b>		
62	Stallion, foaled before the 1st of January, 1862 ..	20	10
63	Stallion, foaled in the year 1862 .. .. .	15	10
64	Mare and foal .. .. .	20	10
65	Two years old Filly .. .. .	15	10

Reference Number in Certificates.	HORSES— <i>continued.</i>						First Prize.	Second Prize.
Class.	SUFFOLK.						£.	£.
66	Stallion, foaled before the 1st of January, 1862 ..						20	10
67	Stallion, foaled in the year 1862 .. .. .						15	10
68	Mare and Foal .. .. .						20	10
69	Two years old Filly .. .. .						15	10
CLYDESDALE.								
70	Stallion, foaled before the 1st of January, 1862 ..						20	10
71	Stallion, foaled in the year 1862 .. .. .						15	10
72	Mare and Foal .. .. .						20	10
73	Two years old Filly .. .. .						15	10
SHEEP.								
LEICESTER.								
74	Shearling Ram .. .. .						20	10
75	Ram of any other age .. .. .						20	10
76	Pen of Five Shearling Ewes, of the same flock ..						15	10
COTSWOLD.								
77	Shearling Ram .. .. .						20	10
78	Ram of any other age .. .. .						20	10
79	Pen of Five Shearling Ewes, of the same flock ..						15	10
LINCOLN AND OTHER LONG-WOOLLED.								
<i>Not qualified to compete as Leicesters or Cotswolds.</i>								
80	Shearling Ram .. .. .						20	10
81	Ram of any other age .. .. .						20	10
82	Pen of Five Shearling Ewes, of the same flock ..						15	10
OXFORDSHIRE DOWN.								
83	Shearling Ram .. .. .						20	10
84	Ram of any other age .. .. .						20	10
85	Pen of Five Shearling Ewes, of the same flock ..						15	10
SOUTHDOWN.								
86	Shearling Ram .. .. .						20	10
87	Ram of any other age .. .. .						20	10
88	Pen of Five Shearling Ewes, of the same flock ..						15	10



Reference Number in Certificates.	SHEEP— <i>continued</i> .	First Prize.	Second Prize.
Class.	SHROPSHIRE.	£.	£.
89	Shearling Ram .. .. .	20	10
90	Ram of any other age .. .. .	20	10
91	Pen of Five Shearling Ewes, of the same flock ..	15	10
	HAMPSHIRE AND OTHER SHORT-WOOLLED.		
	<i>Not qualified to compete as Southdowns or Shropshires.</i>		
92	Shearling Ram .. .. .	20	10
93	Ram of any other age .. .. .	20	10
94	Pen of Five Shearling Ewes, of the same flock ..	15	10
	MOUNTAIN.—CHEVIOTS.		
95	Shearling Ram .. .. .	15	5
96	Ram of any other age .. .. .	15	5
97	Pen of Five Shearling Ewes, of the same flock ..	10	5
	BLACKFACED.		
98	Shearling Ram .. .. .	15	5
99	Ram of any other age .. .. .	15	5
100	Pen of Five Shearling Ewes, of the same flock ..	10	5
	PIGS.		
101	Boar of a large white breed .. .. .	10	5
102	Boar of a small white breed .. .. .	10	5
103	Boar of a small black breed .. .. .	10	5
104	Boar of the Berkshire breed .. .. .	10	5
105	Boar of a breed not eligible for the preceding classes	10	5
106	Breeding Sow of a large white breed .. .. .	10	5
107	Breeding Sow of a small white breed .. .. .	10	5
108	Breeding Sow of a small black breed .. .. .	10	5
109	Breeding Sow of the Berkshire breed .. .. .	10	5
110	Breeding Sow of a breed not eligible for the pre- ceding classes .. .. .	10	5
111	Pen of three Breeding Sow-Pigs of a large white breed, of the same litter, above four and under eight months old .. .. .	10	5
112	Pen of three Breeding Sow-Pigs of a small white breed, of the same litter, above four and under eight months old .. .. .	10	5

Reference Number in Certificates.		First Prize.	Second Prize.
	PIGS— <i>continued.</i>		
Class.		£.	£.
113	Pen of three Breeding Sow-Pigs of a small black breed, of the same litter, above four and under eight months old .. .. .	10	5
114	Pen of three Breeding Sow-Pigs of the Berkshire breed, of the same litter, above four and under eight months old .. .. .	10	5
115	Pen of three Breeding Sow-Pigs of a breed not eligible for the preceding classes, of the same litter, above four and under eight months old ..	10	5
	<i>If Ten Animals or Pens be Exhibited in any Class, a Silver Medal may be awarded to the Third best.</i>		

## II.—IMPLEMENT AND MACHINERY PRIZES OFFERED BY THE SOCIETY.

### I. STEAM CULTIVATION.

£.

The best application of Steam Power for the cultivation of the soil .. .. .	First prize	100
Ditto .. .. ditto .. .. ditto .. ..	Second prize	50
The best application of Steam Power adapted for small occupations .. .. .	First prize	50
Ditto .. .. ditto .. .. ditto .. ..	Second prize	25
For the Class of Ploughs for Steam Power .. .. .		30
Ditto Cultivators .. .. .		30
Ditto Harrows .. .. .		20
Ditto Windlasses, and application of power thereto .. ..		30
Ditto Anchors .. .. .		20
Ditto Rope Porters .. .. .		15

### II. DRAINAGE.

For the Class of Tile and Brick Machines .. .. .		20
For the best Set of Draining Tools .. .. .	Silver medal	

### III. PLOUGHS.

For the Class of Wheel Ploughs .. .. .		30
Ditto Swing Ploughs .. .. .		30
Ditto Subsoil Ploughs .. .. .		10
Ditto Faring Ploughs .. .. .		10

### IV. CULTIVATORS.

For the Class of Cultivators .. .. .		30
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## Special Prizes.

xix

### V. CLODCRUSHERS. £.

For the Class of Clodcrushers .. .. . 20

### VI. ROLLERS.

For the Class of Rollers .. .. . 10

### VII. HARROWS.

For the Class of Harrows .. .. . 20

### VIII. MISCELLANEOUS.

Awards to Agricultural articles, and essential improvements therein  
(10 silver medals)

## III.—SPECIAL PRIZES OFFERED BY THE LOCAL COMMITTEE OF NEWCASTLE-UPON-TYNE.

Reference Number in Certificates.		First Prize.	Second Prize.
	<b>CATTLE.</b>		
	<b>GALLOWAY.</b>		
Class.		£.	£.
116	Bull, calved previous to the 1st of January, 1863	20	10
117	Bull, calved after the 1st of January, 1863 .. ..	20	10
118	Cow, above three years old .. .. .	15	5
119	Heifer, calved previous to the 1st of January, 1863	10	5
120	Heifer, calved after the 1st of January, 1863 ..	10	5
	<b>SHEEP.</b>		
	<b>BORDER LEICESTER.</b>		
121	Shearling Ram .. .. .	15	5
122	Ram of any other age .. .. .	15	5
123	Pen of Five Shearling Ewes, of the same flock ..	10	5
124	Pen of Five Ewes, of any other age, of the same flock	10	5
	<i>Ewes exhibited in this Class must have reared Lambs during the Spring of 1864.</i>		
	<b>HERDWICK.</b>		
125	Shearling Ram .. .. .	15	5
126	Ram of any other age .. .. .	15	5
127	Pen of Five Shearling Ewes, of the same flock ..	10	5

Reference Number in certificates.		First Prize.	Second Prize.
	<b>HORSES.</b>		
Class.		£.	£.
128	Hunter—Mare or Gelding, five or six years old ..	20	5
129	Hunter—Mare or Gelding, four years old .. ..	20	5
130	Hunter—Colt or Filly, three years old .. ..	10	..
131	Roadster—Stallion .. .. .	15	..
132	Roadster—Mare or Gelding, above four years and not exceeding twelve years old; and also not exceeding 15 hands .. .. .	10	..
133	Pony—Gelding, of any age, not exceeding 14 hands	5	..
134	Mountain Mare Pony, of any age, not exceeding 13½ hands, with foal at foot, or stunted .. ..	10	..
135	Pair of Mares or Geldings, or Mare and Gelding, for agricultural purposes .. .. .	10	..
136	Gelding or Filly, three years old, for agricultural purposes .. .. .	10	5
137	Gelding, two years old, for agricultural purposes..	5	..
138	Gelding or Filly, one year old, for agricultural purposes .. .. .	10	5
	<b>WOOL.</b>		
	(Five Fleeces each).		
139	Leicester .. .. .	2	..
140	Cotswold .. .. .	2	..
141	Lincoln and other Long-woolled .. .. .	2	..
142	Oxfordshire Down .. .. .	2	..
143	Southdown .. .. .	2	..
144	Shropshire .. .. .	2	..
145	Hampshire and other Short-woolled .. .. .	2	..
146	Cheviot .. .. .	2	..
147	Blackfaced .. .. .	2	..
148	Herdwick .. .. .	2	..
	<b>BUTTER.</b>		
149	Firkin Butter (one firkin each) .. .. .	5	..
150	Fresh Butter (6 lbs., in single pounds) .. ..	5	..



## CONDITIONS RELATING TO LIVE-STOCK.

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1. No bull above two years old will be eligible for a prize unless certified to have served not less than three different cows (or heifers) within the three months preceding the 1st of June in the year of the Show.

2. No cow will be eligible for a prize unless certified to have had a live calf, either between the date of entry and that of the Show, or within the twelve months preceding the date of the Show.

3. No heifer, except yearlings, entered as in-calf, will be eligible for a prize unless she is certified to have been bulled before the 31st of March in the year of Show, nor will her owner afterwards receive the prize until he shall have furnished the Secretary with a further certificate that she produced a live calf before the 31st of January in the subsequent year.

4. All foals must be the offspring of the mare along with which they are exhibited for the prize.

5. The ewes in each pen must be of the same flock.

6. Sheep exhibited for any of the prizes (except blackfaced mountain and Herdwick sheep, which may be shown in the wool) must have been *really and fairly shorn bare* after the 1st of April in the year of the Exhibition; and the date of such shearing must form part of the Certificate of Entry. Two Inspectors will be appointed by the Council to examine the sheep on their admission to the Show-Yard, with instructions to report to the Stewards any cases in which the sheep have not been *really and fairly shorn bare*.

7. The three sow-pigs in each pen must be of the same litter.

8. The breeding sows in Classes 106, 107, 108, 109, and 110, shall be certified to have had a litter of live pigs within the six months preceding the Show, or to be in-pig at the time of entry, so as to produce a litter before the 1st of September following. In the case of in-pig sows, the prize will be withheld until the Exhibitor shall have furnished the Secretary with a certificate of farrowing, as above.

9. No sow, if above eighteen months old, that has not produced a litter of live pigs, shall be eligible to compete in any of the classes.

10. The Judges of pigs will be instructed, with the sanction of the Stewards, to withhold prizes from any animals which shall appear to them to have been entered in a wrong class; and to affix a placard of disqualification to the pens of those animals.

11. All pigs exhibited at the country meetings of the Society shall be subjected to an examination of their mouths by the Veterinary Inspector of the Society; and should the state of dentition in any pig indicate that the age of the animal has not been correctly returned in the Certificate of Entry, the Stewards shall have power to disqualify such pig, and shall report the circumstance to the Council at its ensuing monthly meeting.

12. If a litter of pigs be sent with a breeding sow, the young pigs must be the produce of the sow, and must not exceed three months old.

13. No horse shall be exhibited without a certificate from a Member of the Royal College of Veterinary Surgeons, as to the state of the animal with reference to hereditary diseases, particularly those of the respiratory and visual

organs; which certificate shall accompany the Certificate of Entry; but that the above shall not supersede the usual examination by the Society's Veterinary Inspector.

14. A form of certificate will be sent to every Exhibitor of horses, to be filled up by a Member of the Royal College of Veterinary Surgeons, certifying to the soundness of every horse exhibited, without which such horse shall not be admitted into the Yard.

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### RULES OF ADJUDICATION.

1. As the object of the Society in giving prizes for neat cattle, sheep, and pigs, is to promote improvement in *breeding* stock, the Judges in making their awards will be instructed not to take into their consideration the present value to the butcher of animals exhibited, but to decide according to their relative merits for the purpose of *breeding*.

2. If, in the opinion of the Judges, there should be equality of merit, they will be instructed to make a special report to the Council, who will decide on the award.

3. The Judges will be instructed to withhold any prize if they are of opinion that there is not sufficient merit in any of the stock exhibited for such prize to justify an award; should, however, the question of disqualifying a whole class arise, the Judges shall consult with the Stewards of the yard, and their joint decision shall be final.

4. The Judges will be instructed to give in a *reserved number* in each class of live stock; viz., which animal would, in their opinion, possess sufficient merit for the prize in case the animal to which the prize is awarded should subsequently become disqualified.

5. In the classes for stallions, mares, and fillies, the Judges in awarding the prizes will be instructed, in addition to symmetry, to take activity and strength into their consideration.

6. The Judges will be instructed to deliver to the Director their award, signed, and stating the numbers to which the prizes are adjudged, before they leave the yard.

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### CONDITIONS RELATING TO MACHINERY.

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#### STEAM-ENGINES.

All engines must be fitted with a steam-indicator, in addition to the ordinary spring-balance.

#### STEAM CULTIVATION.

1. The implements for steam cultivation will be tested dynamometrically, if possible, and such experiments made as will enable the Judges to ascertain the relative value in usefulness of each implement.

2. The steam boiler of each engine must be provided with a pipe or tube, the thread of which must be equal to the "half-inch gas-pipe thread," for the purpose of attaching a forcing pump; and each boiler will be tested to any

pressure the exhibitor thinks fit; but a pressure not exceeding one-half the "test" pressure is the utmost that will be allowed at any time during the whole time the *steam is up* for the Judges' purposes.

3. Any engine which is entered for competition, or for working in the yard of "machinery-in-motion," which, from defect in construction or any other cause, is, in the opinion of the Judges and Consulting Engineer, *unsafe*, shall not be allowed to work on the Society's premises; and further, the word '*unsafe*' shall be attached to the engine during the remainder of the exhibition.

4. The brick and tile machines will be tested by a dynamometer, where practicable; and machines intended to be worked by steam power must be provided with proper riggers, pulleys, or drums, for the application of power to the machines. Those machines intended to be worked by hand-power must be provided with a pulley not less than 4 inches wide; and such pulley or rigger must not be less in radius than the radius of the crank which is sent with the machine, and by which it is usually worked.

5. Every Exhibitor of pipe-machines will be expected to bring a die,  $2\frac{3}{4}$  inches diameter, with the "button" or "triblet" 2 inches diameter; and the machine must cut the pipes to the length of  $13\frac{1}{2}$  inches: also other dies, with triblets, for pipes varying from 1 to 4 inches diameter, or for larger pipes, if the machine is capable of making them.

6. The ploughs to be drawn by horses will be tested by the dynamometer, care being taken that the state of the land, the depth and width of furrow, be as nearly equal as possible in each set of experiments.

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\* \* Forms of Certificate for entry, as well as Prize-Sheets for the Newcastle Meeting, containing the whole of the conditions and regulations, may be obtained at the Office of the Society, No. 12, Hanover Square, London.

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#### DATES OF ENTRY.

CERTIFICATES for the entry of Implements for the Newcastle Meeting must be forwarded to the Secretary of the Society, No. 12, Hanover Square, London (W.), by the 1st of May, and Certificates for the entry of Live Stock by the 1st of June. Certificates received after those respective dates will not be accepted, but returned to the persons by whom they have been sent.

The Prizes of the Royal Agricultural Society of England, and all Prizes offered by the Newcastle Local Committee, are open to general competition.

THE following is the distribution of the Prizes awarded in the Heifer Classes at the Worcester Meeting, the Prizes in which were reserved till Certificates were received of their having respectively produced a live-calf before the 31st January, 1864.

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#### SHORT-HORNS.

LADY PIGOT's First Prize Heifer, "Rosedale," calved a dead calf.  
RICHARD BOOTH's Second Prize Heifer, "Queen of the May 2nd," not in calf.  
COLONEL TOWNELEY's Silver Medal Heifer, "Roan Knight's Butterfly," takes First Prize.  
COLONEL TOWNELEY's Reserved Number Heifer, "Royal Butterfly's Duchess," takes Second Prize.

#### SUSSEX.

MESSRS. HEASMAN's First Prize Heifer, "Batterssea," slung her calf in October from being knocked about on the railway.

The remainder of the In-calf Heifers to which Prizes were awarded at Worcester have produced calves in accordance with the conditions.

H. HALL DARE, Secretary.

*January 31st, 1864.*



## Essays and Reports.

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### AWARDS FOR 1862.

#### CLASS I.

Agriculture of Staffordshire, Prize not awarded : only one Essay sent in.

#### CLASS II.

The Essays in this Class were not considered worthy of the Prize.

#### CLASS III.

The Prize of 20*l.* was awarded to Mr. ROBERT VALENTINE, of Burcott, Wing, Leighton Buzzard, for his Essay on Steam Power and Thrashing Machines.

#### CLASS IV.

The Prize of 10*l.* was awarded to Mr. T. BOWICK, of Bedford, for his Essay on Haymaking.

#### CLASS VI.

In this Class there was no competition.

#### CLASS VIII.

The Prize of 10*l.* was awarded to Mr. T. BOWICK, of Bedford, for his Essay on the Management of a Home Farm.

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## AWARDS FOR 1863.

## CLASS II.

The Prize of 25*l.* was awarded to Professor GAMGEE, of the New Veterinary College, Edinburgh, for his Essay on Breeding Hunters and Roadsters.

## CLASS III.

The Prize of 25*l.* was awarded to Mr. W. J. MOSCROP, of Kirkleatham, Redcar, for his Essay on Steam Cultivation.

## CLASS IV.

The Prize of 25*l.* was awarded to Mr. CHARLES BELCHER, of Little Coxwell, Faringdon, for his Essay on Reclaiming Waste Lands.

## CLASS V.

The Essays in this Class were not considered worthy of the Prize.

## CLASS VIII.

No Prize awarded.

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PRIZES OFFERED BY THE WORCESTER LOCAL COMMITTEE.

The Prize of 20*l.* was awarded to Mr. CLEMENT CADLE, of Ballingham Hall, Ross, for his Essay on the Management of an Orchard.

The Prize of 20*l.* was awarded to Mr. CLEMENT CADLE for his Essay on the Manufacture and Preservation of Cider and Perry.

The Prize of 20*l.* was awarded to Mr. P. SMITH, of Wick, Worcester, for his Essay on the Cultivation of Hops.

## Members' Privileges of Chemical Analysis.

THE Council have fixed the following rates of Charge for Analyses to be made by the Consulting Chemist for the *bonâ-fide* use of Members of the Society; who (to avoid all unnecessary correspondence) are particularly requested, when applying to him, to mention the kind of analysis they require, and to quote its number in the subjoined schedule. The charge for analysis, together with the carriage of the specimens, must be paid to him by members at the time of their application.

No. 1.—An opinion of the genuineness of Peruvian guano, bone-dust, or oil-cake (each sample) .. .. .	5s.
„ 2.—An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts, and ammonia .. .. .	10s.
„ 3.—An estimate of the value (relatively to the average of samples in the market) of sulphate and muriate of ammonia, and of the nitrates of potash and soda .. .. .	10s.
„ 4.—An analysis of superphosphate of lime for soluble phosphates only .. .. .	10s.
„ 5.—An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia .. .. .	£1.
„ 6.—An analysis (sufficient for the determination of its agricultural value) of any ordinary artificial manure .. .. .	£1.
„ 7.—Limestone:—the proportion of lime, 7s. 6d.; the proportion of magnesia, 10s.; the proportion of lime and magnesia .. .. .	15s.
„ 8.—Limestone or marls, including carbonate, phosphate, and sulphate of lime, and magnesia with sand and clay .. .. .	£1.
„ 9.—Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime .. .. .	£1.
„ 10.—Complete analysis of a soil .. .. .	£3.
„ 11.—An analysis of oil-cake, or other substance used for feeding purposes; showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre; as well as of starch, gum, and sugar, in the aggregate .. .. .	£1.
„ 12.—Analyses of any vegetable product .. .. .	£1.
„ 13.—Analyses of animal products, refuse substances used for manure, &c. .. .. .	from 10s. to 30s.
„ 14.—Determination of the “hardness” of a sample of water before and after boiling .. .. .	10s.
„ 15.—Analysis of water of land drainage, and of water used for irrigation .. .. .	£2.
„ 16.—Determination of nitric acid in a sample of water .. .. .	£1.

N.B.—*The above Scale of Charges is not applicable to the case of persons commercially engaged in the Manufacture or Sale of any Substance sent for Analysis.*

The Address of the Consulting Chemist of the Society is, Dr. AUGUSTUS VOELCKER, 101, Leadenhall Street, London, E.C., to which he requests that all letters and parcels (postage and carriage paid) should be directed.

## **Members' Veterinary Privileges.**

### **I.—SERIOUS OR EXTENSIVE DISEASES.**

No. 1. Any Member of the Society who may desire professional attendance and special advice in cases of serious or extensive disease among his cattle, sheep, or pigs, and will address a letter to the Secretary, will, by return of post, receive a reply stating whether it be considered necessary that Professor Simonds, the Society's Veterinary Inspector, should visit the place where the disease prevails.

No. 2. The remuneration of the Inspector will be 2*l.* 2*s.* each day as a professional fee, and 1*l.* 1*s.* each day for personal expenses; and he will also be allowed to charge the cost of travelling to and from the locality where his services may have been required. The fees will be paid by the Society, but the travelling expenses will be a charge against the applicant. This charge may, however, be reduced or remitted altogether at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

No. 3. The Inspector, on his return from visiting the diseased stock, will report to the Committee, in writing, the results of his observations and proceedings, which Report will be laid before the Council.

No. 4. When contingencies arise to prevent a personal discharge of the duties confided to the Inspector, he may, subject to the approval of the Committee, name some competent professional person to act in his stead, who shall receive the same rates of remuneration.

### **II.—ORDINARY OR OTHER CASES OF DISEASE.**

Members may obtain the attendance of the Veterinary Inspector on any case of disease by paying the cost of his visit, which will be at the following rate, viz., 2*l.* 2*s.* per diem, and travelling expenses.

### **III.—CONSULTATIONS WITHOUT VISIT.**

Personal consultation with Veterinary Inspector	..	5 <i>s.</i>
Consultation by letter	.. .. .	5 <i>s.</i>
Consultation necessitating the writing of three or more letters.		10 <i>s.</i>
Post-mortem examination, and report thereon	.. .. .	10 <i>s.</i>

A return of the number of applications during each half-year being required from the Veterinary Inspector.

### **IV.—ADMISSION OF DISEASED ANIMALS TO THE VETERINARY COLLEGE; INVESTIGATIONS, LECTURES, AND REPORTS.**

No. 1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the same terms as if they were Members of the College; viz., by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs "a small proportionate charge to be fixed by the Principal according to circumstances."

No. 2. The College has also undertaken to investigate such particular classes of disease, or special subjects connected with the application of the Veterinary art to cattle, sheep, and pigs, as may be directed by the Council.

No. 3. In addition to the increased number of lectures now given by Professor Simonds—the Lecturer on Cattle Pathology—to the pupils in the Royal Veterinary College, he will also deliver such lectures before the Members of the Society, at their house in Hanover Square, as the Council shall decide.

No. 4. The Royal Veterinary College will from time to time furnish to the Council a detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary.



# Royal Agricultural Society of England.

1864-5.

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JOHNSTONE, Sir J. V. B., Bt., M.P.  
KERRISON, Sir E. C., Bt., M.P.  
MACDONALD, Sir A. K., Bt.  
ACLAND, T. DYKE.  
ARKWRIGHT, J. H.  
DAUBENY, Dr.

DENT, J. D., M.P.  
HOLLAND, Ed., M.P.  
HOSKYNs, C. WREN.  
HUMBERSTON, P. S., M.P.  
HUXTABLE, Ven. Archdeacon.  
LAWES, J. B.  
THOMPSON, H. S., M.P.  
WELLS, WILLIAM.

### Veterinary Committee.

HOOD, Hon. Maj.-Gen. A. NELSON.  
JOHNSTONE, Sir J. V. B., Bt., M.P.  
MILES, Sir Wm., Bt., M.P.  
BARKER, THOS. RAYMOND.  
CHALLONER, Colonel.  
DENT, J. D., M.P.  
GIBBS, B. T. BRANDRETH.

HAMOND, ANTHONY.  
HOBBS, WM. FISHER.  
PAIN, THOS.  
SIMONDS, Professor.  
SPOONER, Professor.  
THOMPSON, H. S., M.P.  
WELLS, WILLIAM.

### Stock-Prizes Committee.

WALSINGHAM, Lord.  
HOOD, Hon. Maj.-Gen. A. NELSON.  
BARNETT, CHARLES.  
BARTHOOPP, NATHANIEL G.  
CLAYDEN, JOHN.  
DENT, J. D., M.P.  
DRUCE, JOSEPH.  
GIBBS, B. T. BRANDRETH.  
HOBBS, WM. FISHER.  
HOLLAND, Ed., M.P.  
HUDSON, JOHN.

JONAS, SAMUEL.  
MILWARD, RICHARD.  
PAIN, THOMAS.  
POPE, EDWARD.  
RANDELL, CHAS.  
RIGDEN, WM.  
SMITH, ROBERT.  
SIMONDS, Professor.  
TORR, WILLIAM.  
TURNER, GEORGE.  
WALLIS, OWEN.

## Implement Committee.

CHESHAM, Lord.  
 HOOD, Hon. Maj.-Gen. A. NELSON.  
 VERNON, Hon. A. H.  
 KERRISON, Sir E. C., Bt., M.P.  
 MACDONALD, Sir A. K., Bt.  
 MILES, Sir WM., Bt., M.P.  
 AMOS, C. E.  
 ARKWRIGHT, J. H.  
 BARNETT, CHARLES.  
 CANTRELL, CHAS. S.  
 CHALLONER, Colonel.

GIBBS, B. T. BRANDRETH.  
 HAMOND, ANTHONY.  
 HOBBS, WM. FISHER.  
 HOLLAND, ED., M.P.  
 HOSKYN, C. WREN.  
 RANDELL, CHARLES.  
 SHUTTLEWORTH, JOSEPH.  
 THOMPSON, H. S., M.P.  
 TORR, WILLIAM.  
 WALLIS, OWEN.  
 WILSON, Professor.

## General Plymouth Committee.

FEVERSHAM, Lord, Chairman.  
 FORTESCUE, Earl.  
 POWIS, Earl of.  
 CHESHAM, Lord.  
 PORTMAN, Lord.  
 TREDEGAR, Lord.  
 HOOD, Hon. Maj.-Gen. A. NELSON.  
 LOPES, Sir MASSEY, Bart., M.P.  
 VERNON, Hon. A. H.  
 MACDONALD, Sir A. K., Bart.  
 RIDLEY, Sir MATTHEW WHITE, Bart., M.P.  
 ACLAND, T. DYKE.  
 ARKWRIGHT, J. HUNGERFORD.  
 BARNETT, CHARLES.  
 BOWLY, EDWARD.  
 BRAMSTON, T. W., M.P.  
 CANTRELL, CHARLES S.

CHALLONER, Colonel.  
 DENT, J. D., M.P.  
 GIBBS, B. T. BRANDRETH.  
 HOBBS, WM. FISHER.  
 HOLLAND, E., M.P.  
 HOSKYN, C. WREN.  
 KINGSCOTE, Col., M.P.  
 MILWARD, RICHARD.  
 PAIN, THOMAS.  
 PLYMOUTH, Mayor of.  
 POPE, EDWARD.  
 RANDELL, CHARLES.  
 SHUTTLEWORTH, JOSEPH.  
 THOMPSON, H. S., M.P.  
 TORR, WILLIAM.  
 TREMAYNE, JOHN.  
 TURNER, GEORGE.

\* \* The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.



## MEMORANDA.

**ADDRESS OF LETTERS.**—The Society's office being situated in the postal district designated by the letter **W**, members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

**GENERAL MEETING** in London, in December, 1864.

**GENERAL MEETING** in London, May 22, 1865, at Twelve o'clock.

**MEETING** at Plymouth, in 1865.

**MONTHLY COUNCIL** (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

**WEEKLY COUNCIL** (for practical communications), at 12 o'clock on all Wednesdays in February, March, April, May, June, July, and November, excepting the first Wednesday in each of those months, and during adjournment: open to all Members of the Society, who are particularly invited by the Council to avail themselves of this privilege.

**ADJOURNMENTS.**—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

**DISEASES of Cattle, Sheep, and Pigs.**—Members have the privilege of applying to the Veterinary Committee of the Society; and of sending animals to the Royal Veterinary College, on the same terms as if they were subscribers to the College.—(A statement of these privileges will be found in the present Appendix.)

**CHEMICAL ANALYSIS.**—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in the Appendix of the present volume.

**LOCAL CHEQUES.**—Members are particularly requested not to forward Country Cheques for payment in London; but London Cheques, or Post-office Orders on Vere-street (payable to **H. HALL DARE**), in lieu of them. All Cheques are required to bear upon them a penny draft or receipt stamp, which must be cancelled in each case by the initials of the drawer. They may also conveniently transmit their Subscriptions to the Society, by requesting their Country Bankers to pay (through their London Agents) the amount at the Society's Office (No. 12, Hanover Square, London), between the hours of ten and four, when official receipts, signed by the Secretary, will be given for such payments.

**NEW MEMBERS.**—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary.

**PACKETS BY POST.**—Packets not exceeding two feet in length, width, or depth, consisting of written or printed matter (but not containing letters sealed or open), if sent without envelopes, or enclosed in envelopes open at each end, may be forwarded by the inland post, if stamped, at the following rates:—

For a packet not exceeding	4 ounces (or quarter of a pound)	. . .	1 penny
"	"	8 "	(or half a pound) . . . 2 pence.
"	"	16 "	(or one pound) . . . 4 "
"	"	24 "	(or one pound and a half) . . 6 "
"	"	32 "	(or two pounds) . . . 8 "

[And so on in the proportion of 8 ounces for each additional 2*d.*]

\* \* Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-Laws, of a Statement of the General Objects, &c., of the Society, of Chemical and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

## Royal Agricultural Society of England.

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### GENERAL MEETING,

12, HANOVER SQUARE, MONDAY, MAY 23, 1864.

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### REPORT OF THE COUNCIL.

THE Council have the gratification of announcing that since the last General Meeting in December, His Royal Highness the Prince of Wales has allowed his name to be enrolled in the list of your Governors.

During the past five months the names of 5 Governors and 136 members have been removed from the list by death and retirement, while 1 Governor and 232 members have been elected; so that the Society now consists of—

78 Life Governors,  
45 Annual Governors,  
1,343 Life Members,  
4,013 Annual Members,  
17 Honorary Members,

making a total of 5,496, being an increase of 53 names.

The Council have elected Major-General the Hon. Alexander Nelson Hood as a Vice-President, in the room of Lord Ashburton, deceased.

The half-yearly statement of accounts to the 31st December, 1863, has been examined and approved by the auditors and accountants of the Society, and together with the Balance-Sheet for the whole year 1863, and a statement of the Country Meeting account for Worcester, has been published in the last number of the 'Journal.' The funded capital stands at 16,488*l.* 17*s.* 10*d.* in the New Three per Cents.; 3000*l.* has been placed on deposit at interest with the Society's bankers, and the current cash balance in their hands on the 1st inst. was 2836*l.* 6*s.* 6*d.*

Papers have been read at the Weekly Meetings by Mr. Lawes, on "Salt used as a Manure;" by Mr. Hughes, on "The Cultivation and Management of Clay Farms;" by Mr. Holland, M.P., on "Agricultural Education;" and by Professor Voelcker, on "Nutrition of Plants by the Atmosphere."

A Committee has been appointed to consider the measures which ought to be taken for the improvement of the education of those who depend upon the cultivation of the soil for their support, this being declared by the Charter as the seventh national object to be prosecuted by the Society.

The Lords Commissioners of Her Majesty's Treasury having applied to the Society for assistance in carrying out their design of presenting some sheep to the Viceroy of Egypt, who is anxious to improve his native breeds by crossing, a selection was made under the direction of the President; and a communication has been received of the safe arrival of the sheep at Cairo.

A Special Committee having been appointed to consider the question of the dates of calving, the Council have approved of their recommendation, that any alteration in the date of calving would be inconvenient and thus inadvisable.

The arrangements for the Newcastle Meeting, to be held during the week commencing Monday the 18th July, are proceeding satisfactorily. The show-yard will be open as under:—

						<i>s.</i>	<i>d.</i>
Monday	..	..	..	..	..	10	0
Tuesday	..	..	..	..	..	2	6
Wednesday	..	..	..	..	..	2	6
Thursday	..	..	..	..	..	1	0
Friday	..	..	..	..	..	1	0

The Council have determined that the Annual Country Meeting in 1865 shall be held at Plymouth.

The district for the Country Meeting of 1866 will include the counties of Cambridgeshire, Essex, Hertfordshire, Huntingdonshire, Norfolk, and Suffolk.

By Order of the Council,

H. HALL DARE,

Secretary.

Dr.

### HALF-YEARLY CASH ACCOUNT

To Balance in hand, 1st January, 1864:—	£.	s.	d.	£.	s.	d.
Bankers .. .. .	443	12	6			
Secretary .. .. .	17	13	5			
				461	5	11
To Income, viz.:—						
Dividends on Stock .. .. .	240	2	5			
Subscriptions:—	£.	s.	d.			
Governors' Annual .. .. .	380	0	0			
Members' Life-Compositions ..	390	0	0			
Members' Annual .. .. .	3291	7	0			
				4061	7	0
Journal:—						
Sales .. .. .	89	14	0			
				4391	3	5
To Country Meetings:—						
Worcester .. .. .	7	5	0			
Newcastle-on-Tyne .. .. .	3498	7	0			
				3505	12	0
				7896	15	5
				£8358	1	4

## BALANCE-SHEET.

LIABILITIES.		£.	s.	d.	£.	s.	d.
To Capital:							
Surplus, 31st December, 1863	.. .. .	..	..	..	18,342	17	0
Surplus of Income over the Expenditure during the Half-year, viz:—							
Income	.. .. .	4391	3	5			
Expenditure	.. .. .	1331	8	6			
		<hr/>			3059	14	11
Less Worcester Meeting:—							
Amount at debit of this account	.. .. .				47	15	0
					<hr/>		
					3,011	19	11
					<hr/>		
					£21,354	16	11

(Signed)

W. FISHER HOBBS, *on behalf of Finance Committee.*



# SOCIETY OF ENGLAND.

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FROM 1ST JANUARY TO 30TH JUNE, 1864.

CR.

	£.	s.	d.	£.	s.	d.	£.	s.	d.
By Expenditure:—									
Establishment—									
Official Salaries and Wages ..	327	6	0						
House Expenses, Rent, Taxes, &c.	269	5	6						
				596	11	6			
Journal:—									
Postage and Advertising, &c. ..	107	7	0						
Wood Cuts .. .. .		3	17						
Editor's Salary .. .. .	250	0	0						
				361	4	0			
Chemical:—									
Grant for Investigations, 1864 ..	200	0	0						
Consulting Chemist's Salary ..	75	0	0						
				275	0	0			
Veterinary .. .. .				8	19	6			
Postage and Carriage .. .. .				44	1	6			
Advertisements .. .. .				13	12	0			
Sundries .. .. .				16	19	0			
Subscriptions returned (paid in error) .. ..				15	1	0			
				1331	8	6			
By Country Meetings:—									
Worcester .. .. .	55	0	0						
Newcastle-on-Tyne .. .. .	1141	16	7						
				1196	16	7			
							2528	5	1
By Balance in hand:—									
By Deposit with London and Westminster Bank ..				3000	0	0			
Bankers .. .. .	2817	3	11						
Secretary .. .. .	12	12	4						
				2829	16	3			
							5829	16	3
							£8358	1	4

30TH JUNE, 1864.

ASSETS.	£.	s.	d.	£.	s.	d.
By Cash in hand .. .. .	2,829	16	3			
By Deposit Account at Bankers .. .. .	3,000	0	0			
By New 3 per cent. Stock, 16,488 <i>l.</i> 17 <i>s.</i> 10 <i>d.</i> cost ..	15,881	11	1			
By Books and Furniture in Society's House .. ..	2,000	0	0			
				23,711	7	4
<i>Mem.</i> —The above Assets are exclusive of the amount recoverable in respect of arrears of Subscription to 30th June, 1864, which at that date amounted to 737 <i>l.</i>						
Less at Credit of Newcastle Meeting .. .. .						
				2,356	10	5
				£21,354	16	11

Examined, audited, and found correct, this 2nd day of August, 1864.

(Signed) WILLIAM COPELAND ASTBURY.  
 QUILTER, BALL, & Co., *Accountants.*

# SHOW AT NEWCASTLE-UPON-TYNE, JULY, 1864.

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## STEWARDS OF THE YARD.

### Stock.

RICHARD MILWARD.  
JOHN D. DENT, M.P.  
CHARLES RANDELL.

### Implements.

WILLIAM TORR.  
EARL CATHCART.  
The HON. A. H. VERNON.

### Forage.

JACOB WILSON.

### Honorary Director of the Show.

B. T. BRANDRETH GIBBS.

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## STOCK JUDGES.

### Short-horns.

T. PARKINSON,  
R. J. WILEY,  
JOSEPH ROBINSON.

### Herefords, Devons, and Sussex.

E. L. FRANKLIN,  
H. W. KEARY,  
E. GOUGH.

### Channel Islands, and other Breeds.

JOHN HUDSON,  
WILLIAM FISHER HOBBS.

### Polled, Horned, Ayrshire, and Galloways.

A. GLENNIE,  
J. MURDOCK,  
W. FULLERTON.

### Thorough-breds and Hunters.

J. COOKSON,  
H. THURNALL,  
C. N. NAINBY.

### Hackneys and Ponies.

C. BEDFORD,  
HON. G. LASCELLES.

### Agricultural and Drays.

T. BROOKS,  
G. BOTHAM,  
J. H. BLAND.

### Suffolks and Clydesdales.

H. CROSSE,  
J. STEEDMAN.

### Leicesters and Lincolns.

J. B. THOMPSON,  
L. BORMAN,  
T. GREETHAM.

### Cheviots, Border Leicesters, Black- Faced, and Herdwicks.

W. AITCHISON,  
WILLIAM SMITH,  
J. BOWSTEAD.

### Cotswolds.

J. H. BATEMAN,  
R. LORD.

### Oxford and Hampshire Downs.

F. BUDD,  
R. J. NEWTON,  
E. LITTLE.

### Shropshire.

J. WOODS,  
J. PRICE.

### Southdowns.

J. H. FOKES,  
J. S. TURNER,  
J. PURVES.

### Pigs.

J. WOOLF,  
D. NESHAM,  
J. MOON.

WOOL JUDGES.

T. CLAYTON,

JASON GURNEY.

---

BUTTER JUDGES.

T. HUNNAM,

J. MARSHALL.

---

Inspector of Shearing.

S. DRUCE.

Veterinary-Inspectors.

PROFESSOR SIMONDS,

PROFESSOR VARNELL.

*Assistant.*—R. L. HUNT.

---

IMPLEMENT JUDGES.

**Steam-Cultivators.**

D. K. CLARK, C.E.,

H. B. CALDWELL,

J. COLEMAN,

C. S. READ,

F. SHERBORN, JUN.

**Ploughs.**

T. DODS,

E. WORTLEY,

T. P. OUTHWAITE.

**Cultivators, Clod-Crushers, Rollers, and Harrows.**

JOHN HICKIN,

JOHN THOMPSON.

**Brick and Tile Machines and Miscellaneous.**

W. TINDALL,

GILSON MARTIN.

---

**Consulting-Engineer.**

C. E. AMOS.

## AWARD OF PRIZES.

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NOTE.—The Judges were instructed to give in a *Reserved Number* to one animal in each Class, viz., the animal which would in their opinion possess sufficient merit for the Prize, in case an animal to which a Prize was awarded should subsequently become disqualified. If ten animals or pens were exhibited in any Class, a Silver Medal might be awarded to the Third best.

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### CATTLE.

#### *Short-horn Bulls and Bull Calves.*

AMOS CRUICKSHANK, Sittyton, Whiterashes, Aberdeenshire: FIRST PRIZE, 25*l.*, for "Forth," roan, 4 years 5 months 6 days-old; bred by William Stirling, M.P., Keir, Dumblane, Perthshire; sire, "Florist" (16,064); dam, "Anna Rose;" sire of dam, "John o'Groat" (13,090).

VISCOUNT STRATHALLAN, Strathallan Castle, Auchterarder, Perthshire: SECOND PRIZE, 15*l.*, for "Fosco," white, 3 years 6 months 2 weeks 2 days-old; bred by exhibitor; sire, "Redgauntlet;" dam, "Frolic;" sire of dam, "Barnaby Rudge."

DAVID REYNOLDS DAVIES, Mere Old Hall, Knutsford, Cheshire: THIRD PRIZE, Silver Medal, for "Ebor," roan, 3 years 9 months-old; bred by Mr. Barker, Donnington; sire, "Horner" (14,714); dam, "Lady Mayoress;" sire of dam, "Voltigeur."

JOHN CHARLESWORTH, Headfield, Dewsbury, Yorkshire: the *Reserved Number*, to "General Murat" (17,955), roan, 4 years 2 months 3 weeks-old; bred by exhibitor; sire, "Prince Talleyrand" (16,765); dam, "Village Belle;" sire of dam, "Grand Turk" (12,968).

WILLIAM STIRLING, M.P., Keir, Dunblane, Perthshire: FIRST PRIZE, 25*l.*, for "Royal Butterfly 11th" (20,719), roan, 2 years 11 months 3 weeks 6 days-old; bred by Colonel Charles Towneley, Towneley Park, Burnley, Lancashire; sire, "Royal Butterfly" (16,862); dam, "Pageant;" sire of dam, "Count Glo'ster" (12,650).

JONATHAN PEEL, Knowlmore Manor, Clitheroe: SECOND PRIZE, 15*l.*, for "Abbot of Knowlmore," roan, 2 years 3 months 1 day-old; bred by exhibitor; sire, "The Monk" (11,824); dam, "Princess Maud;" sire of dam, "Prince Arthur" (13,497).

RICHARD EASTWOOD, Thorney Holme, Clitheroe, Lancashire: THIRD PRIZE, Silver Medal, for "The Hero," white, 2 years 1 month 3 weeks-old; bred by exhibitor; sire, "Priam" (16,710); dam, "Heroine;" sire of dam, "Bridesman" (2,493).

ROBERT GELL, Grimston Lodge, York: the *Reserved Number*, to "Master Goldschmidt" (20,305), roan, 2 years 5 months 5 days-old; bred by exhibitor; sire, "The Rajah" (18,665); dam, "Jenny Lind;" sire of dam, "Vanguard" (10,994).



- THOMAS WILLIS, Manor House, Carperby, Bedale, Yorkshire: FIRST PRIZE, 25*l.*, for "Baron Crossley" (19,269), roan, 1 year 11 months-old; bred by exhibitor; sire, "Royal Alfred" (18,748); dam, "Flower Girl;" sire of dam, "Gipsy King" 11,532).
- ARTHUR JAMES BALFOUR, Whittingham, Prestonkirk, Haddingtonshire: SECOND PRIZE, 25*l.*, for "Prince Loth," roan, 1 year 5 months 5 days-old; bred by exhibitor; sire, "Great Seal" (19,905); dam, "Rose of May;" sire of dam, "Sir James the Rose" (15,290).
- RICHARD BOOTH, Warlaby, Northallerton, Yorkshire: THIRD PRIZE, Silver Medal, for "Prince of Battersea," red and white, 1 year 9 months 3 weeks 4 days-old, bred by exhibitor; sire, "Prince Arthur" (13,497); dam, "Queen of the Ocean;" sire of dam, "Crown Prince" (10,087).
- FRANCIS HAWKSWORTH FAWKES, Farnley Hall, Otley, Yorkshire: the *Reserved Number*, to "Lord Surrey," roan, 1 year 2 months 3 weeks 4 days-old; bred by exhibitor: sire, "Lord Cobham" (20,164); dam, "She's coming again;" sire of dam, "Laudable" (9282).
- FRANCIS HAWKSWORTH FAWKES: FIRST PRIZE, 10*l.*, for "Marquis," red, 9 months 1 week, 4 days-old; bred by exhibitor; sire, "Royal Oak" (16,873); dam, "Marchioness;" sire of dam, "Robinson Crusoe" (13,610).
- RICHARD BOOTH, Warlaby, Northallerton, Yorkshire: SECOND PRIZE, 5*l.*, for "British Crown," roan, 9 months 3 weeks 3 days-old; bred by exhibitor; sire, "Lord of the Valley" (14,837); dam, "Bridal Wreath;" sire of dam, "Crown Prince" (10,087).
- ROBERT HARRETT, Kirkwhelpington, Newcastle-on-Tyne: THIRD PRIZE, Silver Medal, for "Talleyrand," roan, 6 months 2 weeks 2 days-old; bred by exhibitor; sire, "Gipsy Prince" (17,965); dam, "Moss Rose;" sire of dam, "Moss Trooper" (13,357).
- LORD BRAYBROOKE, Audley End, Saffron Walden, Essex: the *Reserved Number*, to "Volunteer," white, 11 months 2 weeks 4 days-old; bred by exhibitor; sire, "Englishman" (19,701); dam, "Lady Augusta Burdett;" sire of dam, "Young Duke of Cambridge" (14,433).

*Short-horn Cows and Heifers.*

- SIR MATTHEW WHITE RIDLEY, Bart., M.P., Blagdon, Cramlington, Northumberland: FIRST PRIZE, 20*l.*, for "Evelina 4th," dark roan, 4 years 2 months 3 days-old, in-calf; bred by exhibitor; sire, "Sir Colin" (16,953); dam, "Evelina;" sire of dam, "Lauderdale."
- JAMES DOUGLAS, Athelstaneford Farm, Drem, Haddingtonshire: SECOND PRIZE, 10*l.*, for "Lady of Athelstane," red and white, 7 years 3 months 3 weeks 5 days-old, in-milk and in-calf; bred by exhibitor; sire, "Hymen" (13,058); dam, "Playful;" sire of dam, "Fourth Duke of York" (10,167).
- RICHARD STRATTON, Walls Court, Stapleton, Bristol: THIRD PRIZE, Silver Medal, for "Luna," roan, 4 years 4 months 2 weeks-old, in-milk; bred by exhibitor; sire, "The Baronet" (17,088); dam, "Lena;" sire of dam, "Hickory."
- JAMES DOUGLAS, Athelstaneford Farm, Drem, Haddingtonshire, the *Reserved Number*, to "Queen of Athelstane," red, 4 years 2 months 2 days-old, in-milk: bred by exhibitor; sire, "Sir James the Rose" (15,290); dam, "Playful;" sire of dam, "Fourth Duke of York."

xlii     *Award of Live-Stock Prizes at Newcastle-upon-Tyne.*

JAMES DOUGLAS: FIRST PRIZE, 15*L.*, for "Pride of Athelstane," red and white, 2 years 11 months 3 weeks 4 days-old, in-milk; bred by exhibitor; sire, "Sir James the Rose" (15,290); dam, "Lady of Athelstane;" sire of dam, "Hymen" (13,058).

WILLIAM LAMBERT, Elrington Hall, Haydon Bridge, Northumberland: SECOND PRIZE, 10*L.*, for "Queen of Beauty," white, 2 years 2 months 1 week 2 days-old, in-calf; bred by exhibitor; sire, "Master Annandale" (14,916); dam, "Garland;" sire of dam, "Speculation" (8621).

RICHARD STRATTON: THIRD PRIZE, Silver Medal, for "Diadem," rich roan, 2 years 5 months 2 weeks 3 days-old, in-calf; bred by exhibitor; sire, "Warwick" (19,120); dam, "Lotus;" sire of dam, "Buckingham" (15700).

RICHARD EASTWOOD, Thorney Holme, Clitheroe, Lancashire: the *Reserved Number*, to "Barmpton Butterfly," rich roan, 2 years 7 months 3 weeks 2 days-old, in-milk; bred by Colonel Towneley, Towneley Park, Burnley; sire, "Royal Butterfly" (16,682); dam, "Young Barmpton Rose;" sire of dam, "Richard Cœur de Lion" (13,590).

GEORGE SAVILE FOLJAMBE, Osberton Hall, Worksop, Notts: FIRST PRIZE, 15*L.*, for "Gipsy Queen," roan, 1 year 8 months 2 weeks-old; bred by exhibitor; sire, "Imperial Windsor;" dam, "Sibyl;" sire of dam, "May Duke."

A. and A. MITCHELL, Alloa, Clackmannanshire: SECOND PRIZE, 10*L.*, for "Blue Belle," roan, 1 year 4 months 3 weeks 6 days-old; bred by exhibitors; sire, "Knight Errant" (18,154); dam, "Barbelle;" sire of dam, "Cardigan" (12,556).

RICHARD EASTWOOD, Thorney Holme, Whitewell, Lancashire: THIRD PRIZE, Silver Medal, for "Royal Butterfly's Pageant," red and white, 1 year 10 months 3 weeks 5 days-old, in-calf; bred by Colonel Towneley, Towneley Park, Burnley; sire, "Royal Butterfly" (16,862); dam, "Pageant;" sire of dam, "Count Glo'ster" (12,650).

RICHARD BOOTH, Warlaby, Northallerton, Yorkshire: the *Reserved Number*, to "Lady Fragrant," roan, 1 year 4 months-old; bred by exhibitor; sire, "Lord of the Valley" (14,837); dam, "Lady Blithe;" sire of dam, "Windsor" (14,013).

SIR ANTHONY DE ROTHSCHILD, Bart., Aston Clinton, Tring, Buckinghamshire: SECOND PRIZE, 10*L.*, for "Isabella Graceful," red with little white, 10 months 3 weeks 5 days-old; bred by exhibitor; sire, "Fortunatus" (19,773); dam, "Graceful;" sire of dam, "Shrewsbury" (20,801).

LORD FEVERSHAM, Duncombe Park, Helmsley, Yorkshire: SECOND PRIZE, 5*L.*, for "Princess," roan, 9 months 5 days-old; bred by exhibitor; sire, "Vesuvius;" dam, "Lady in White;" sire of dam, "Skyrocket."

JAMES DOUGLAS: THIRD PRIZE, Silver Medal, for "Princess of Athelstane," red, 11 months 3 weeks 4 days-old; bred by exhibitor; sire, "Watchman" (17,216); dam, "Queen of Athelstane;" sire of dam, "Sir James the Rose" (15,290).

THOMAS EDWARD PAWLETT, Beeston, Sandy, Bedfordshire: the *Reserved Number*, to "Fair Belle," white, 11 months 1 week 2 days-old; bred by exhibitor; sire, "Englishman" (19,701); dam, "Daisy;" sire of dam, "Merry Lad" (14,947).

*Hereford Bulls and Bull Calves.*

- WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: FIRST PRIZE, 25*l.*, for "Tambarine" (2254), red, white face, 3 years 10 months 2 weeks-old; bred by Lord Bateman, Shobdon Court, Leominster; sire, "Carlisle" (923); dam, "Little Beauty;" sire of dam, "Andrew the Second" (612).
- JOHN MEREDITH, The Helder, Half-way House, Shrewsbury: SECOND PRIZE, 15*l.*, for "Sunbeam" (2248), red, white face and mane, 3 years 7 months, 2 weeks 6 days-old; bred by T. L. Meire, Count Harbour, Shrewsbury; sire, "Franky" (1243); dam, "Rose;" sire of dam, "Count" (1193).
- JOHN ALBERT HOLLINGS, How Caple, Ross, Herefordshire: the *Reserved Number*, to "Chieftain the Second" (1917), red, white face, 3 years 11 months 3 weeks-old; bred by the late James Rea, Monaughty, Knighton; sire, "Wellington" (1112); dam, "Gertrude;" sire of dam, "Chieftain" (930).
- JOHN BALDWIN, Luddington, Stratford-on-Avon, Warwickshire: FIRST PRIZE 25*l.*, for "Battersea" (1865), red and white, 2 years 11 months 2 weeks 1 day-old; bred by Charles VEVERS, Ivington Park, Leominster; sire, "Corn Exchange" (1935); dam, "Pigeon;" sire of dam, "Young Sir Andrew" (1471).
- GEORGE PITT, Chadnor Court, Dilwyn, Leominster, Herefordshire: SECOND PRIZE, 15*l.*, for "San Jacinto," red with white face, 2 years 10 months 1 week 3 days-old; bred by exhibitor; sire, "Hatfield;" dam, "Duchess;" sire of dam, "White Nob."
- JAMES MARSH READ, Elkstone, Cheltenham, Gloucestershire: the *Reserved Number*, to "Peremptorily," red with white face, 2 years 5 months 3 weeks 3 days-old; bred by exhibitor; sire, "Caliban" (1163); dam, "Beauty;" sire of dam, "Dodmore" (1217 A).
- THOMAS DUCKHAM, Baysham Court, Ross, Herefordshire: FIRST PRIZE, 25*l.*, for "Commodore," red, white face, 1 year 10 months 3 weeks 2 days-old; bred by exhibitor; sire, "Castor" (1900); dam, "Carlisle;" sire of dam, "Albert Edward" (859).
- EDMUND WRIGHT, Halston Hall, Oswestry, Salop: SECOND PRIZE, 15*l.*, for "Lion," red, white face, 1 year 11 months 3 weeks 4 days-old; bred by exhibitor; sire, "Magnet 2nd" (989); dam, "Lioness;" sire of dam, "Carlisle" (923).
- WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: the *Reserved Number*, for "Tambarine the Second," red, white face, 1 year 5 months 2 weeks-old; bred by exhibitor; sire, "Tambarine" (2254); dam, "Dewsall;" sire of dam, "Hereford" (968).
- EDMUND WRIGHT, Halston Hall, Oswestry, Salop: FIRST PRIZE 10*l.*, for "Sir John," red, white face, 9 months 1 week 5 days-old; bred by exhibitor; sire, "Silver Horn" (2213); dam, "Sweetmeat;" sire of dam, "Magnet 2nd" (989).
- THOMAS SKINNER BRADSTOCK, Cobrey Park, Ross, Herefordshire: SECOND PRIZE, 5*l.*, for his red, white face and mane, 10 months 1 week 1 day-old; bred by exhibitor; sire, "Young Rambler;" dam, "Maria;" sire of dam, "Berwick."

*Hereford Cows and Heifers.*

- LOUISA WOODGATE REA, Westonbury, Pembridge, Leominster, Herefordshire: FIRST PRIZE, 20*l.*, for "Spangle the 2nd," red, white face, 4 years 9 months 2 weeks 1 day-old, in-milk; bred by the late Mr. James Rea, Monaughty, Knighton; sire, "Wellington;" dam, "Spangle."

LOUISA WOODGATE REA, Westonbury : SECOND PRIZE, 10*l.*, for "Kate the 2nd," red, white face, 5 years 8 months 4 weeks 1 day-old, in-milk ; bred by the late Mr. Thomas Rea, Westonbury ; sire, "Sir Benjamin ;" dam, "Kate."

GEORGE PITT, Chadnor Court, Dilwyn, Leominster : the *Reserved Number*, to "Sunshine," light red, 3 years 6 months 2 weeks 2 days-old, in-milk and in-calf ; bred by exhibitor ; sire, "Luck's All ;" dam, "Handsome ;" sire of dam, "Plunder."

JOHN BALDWIN, Luddington, Stratford-on-Avon, Warwickshire : FIRST PRIZE, 15*l.*, for "Duchess of Bedford 2nd," red and white, 2 years 9 months 1 week-old, in-calf ; bred by Thomas Roberts, Ivington Bury, Leominster, Herefordshire ; sire, "Sir Thomas" (2228) ; dam, "Duchess of Bedford ;" sire of dam, "Arthur Napoleon" (910).

JAMES TAYLOR, Stretford Court, Leominster : SECOND PRIZE, 10*l.*, for, "Dainty 9th," red, mottle face, 2 years 11 months 2 weeks 3 days-old, in-calf ; bred by exhibitor ; sire, "Croft" (937) ; dam, "Dainty 5th ;" sire of dam, "St. Oswald" (1378).

JAMES MARSH READ, Elkstone, Cheltenham, Gloucestershire : the *Reserved Number*, for "Miss Southam," red, white face, 2 years 10 months 3 weeks 3 days-old, in-calf ; bred by exhibitor ; sire, "Caliban" (1163) ; dam, "Cherry 7th ;" sire of dam, "Hotspur" (855).

JOHN BALDWIN, Luddington, Stratford-on-Avon, Warwickshire : FIRST PRIZE, 15*l.*, for "Miss Hastings 2nd," red and white, 1 year 11 months 2 weeks 4 days-old ; bred by Thomas Roberts, Ivington Bury, Leominster, Herefordshire ; sire, "Sir Thomas" (2228) ; dam, "Lady Hastings ;" sire of dam, "Master Butterfly" (1313).

MAJOR-GENERAL THE HON. A. N. HOOD, Cumberland Lodge, Windsor, Berkshire : SECOND PRIZE, 10*l.*, for "Crown Princess," red and white, 1 year 9 months 4 weeks-old ; bred by the exhibitor ; sire, "Ajax" (1843) ; dam, "Juno ;" sire of dam, "Brecon" (918).

JOHN MONKHOUSE, The Stow, Hereford : the *Reserved Number*, to "Isabel," red, white face, 1 year 4 months 3 days-old ; bred by exhibitor ; sire, "Chieftain ;" dam, "Violet ;" sire of dam, "Madoc."

JOHN MONKHOUSE : FIRST PRIZE, 10*l.*, for "Fairy Queen," red, white face, 10 months 2 days old ; bred by exhibitor ; sire, "Chieftain ;" dam, "Fairy ;" sire of dam, "Formidable."

ANDREW ROUSE BOUGHTON KNIGHT, Downton Castle, Ludlow, Herefordshire : SECOND PRIZE, 5*l.*, for "Greyling," grey, 8 months 2 weeks 1 day-old ; bred by exhibitor ; sire, "Lord Grey" (2085) ; dam, "Snowdrop ;" sire of dam, "Orleton" (901).

PHILIP TURNER, The Leen, Pembridge, Herefordshire : the *Reserved Number*, to "Pansy," red, white face, 11 months 3 weeks 3 days-old ; bred by exhibitor ; sire, "Bolingbroke" (1883) ; dam, "Florist ;" sire of dam, "Felix" (953).

#### *Devon Bulls and Bull Calves.*

WALTER FARTHING, Stowey Court, Bridgewater, Somersetshire : FIRST PRIZE, 25*l.*, for "Viscount," red, 4 years 7 months 2 weeks-old ; bred by exhibitor ; sire, "Sir Peregrine ;" dam, "Molly ;" sire of dam, "William."



JAMES MERSON, Brinsworthy, North Molton, Devonshire: **SECOND PRIZE**, 15*l.*, for "Young Salisbury" (761), red, 4 years 5 months 3 days-old; bred by exhibitor; sire, "Napoleon" (464); dam, "Duchess" (1296); sire of dam, "Uncle Tom."

JOHN AZARIAH SMITH, Bradford Peverill, Dorchester, Dorsetshire: **FIRST PRIZE**, 25*l.*, for "Constitution," red, 2 years 3 months 4 weeks 1 day-old; bred by exhibitor; sire, "Exchange" (627); dam, "Rachel" (2307); sire of dam, "Palmerston" (476).

MAJOR-GENERAL THE HON. A. NELSON HOOD, Cumberland Lodge, Windsor, Berkshire: **SECOND PRIZE**, 15*l.*, for "Prince Alfred," 2 years 10 months 4 weeks-old; bred by H. R. H. the Prince Consort, of Windsor Castle; sire "Colonel" (387); dam, "Fancy" (703); sire of dam, "William."

WALTER FARTHING, Stowey Court, Bridgewater, Somersetshire: the *Reserved Number*, to "Stowey," red, 2 years 4 months 3 weeks-old; bred by J. K. Farthing, of Currypool, Bridgewater, Somersetshire; sire, "Sir Alexander;" dam, "Dairymaid;" sire of dam, "Baronet."

WALTER FARTHING: **FIRST PRIZE**, 25*l.*, for "Marquis," red, 1 year 6 months-old; bred by exhibitor; sire, "Sir Peregrine;" dam, "Molly;" sire of dam, "William."

WALTER FARTHING: **SECOND PRIZE**, 15*l.*, for "Saint Andries," red, 1 year 8 months 4 days-old; bred by Sir A. A. Hood, Bart., M.P., of Saint Andries, Bridgewater; sire, "Perfection."

GEORGE TURNER, Beacon Downes, Exeter, Devonshire: the *Reserved Number*, to "Van de Weyer," red, 1 year 6 months 2 weeks 4 days-old; bred by exhibitor; sire, "Champion;" dam, "Vaudine;" sire of dam, "Palmerston."

GEORGE TURNER: **FIRST PRIZE**, 10*l.*, for "Frederick 2nd," red, 7 months 3 weeks-old; bred by exhibitor; sire, "The Liberal;" dam, "Frederica;" sire of dam, "Prince Frederick."

### *Devon Cows and Heifers.*

JOHN AZARIAH SMITH, Bradford Peverill, Dorchester, Dorsetshire: **FIRST PRIZE**, 20*l.*, for "Young Hebe," red, 4 years 9 months 3 weeks 2 days-old, in-milk; bred by Lord Portman, of Bryanston, Blandford, Dorsetshire; sire, Davey's "Napoleon 3rd" (464); dam, "Hebe" (220); sire of dam, "Baronet" (6).

WALTER FARTHING, Stowey Court, Bridgewater, Somersetshire: **SECOND PRIZE**, 10*l.*, for "Cheerful," red, 8 years 1 month 1 week-old, in-milk; bred by Mr. Norrish, of Shoebrooke, Crediton, Devonshire.

JOHN AZARIAH SMITH: the *Reserved Number*, to "Young Gold Cup," red, 4 years 8 months 4 weeks 1 day-old, in-milk; bred by Lord Portman, of Bryanston, Blandford, Dorsetshire; sire, "Palmerston" (476); dam, "Gold Cup."

WALTER FARTHING, Stowey Court, Bridgewater, Somersetshire: **FIRST PRIZE**, 15*l.*, for "Nelly," red, 2 years 2 months 1 week-old; bred by exhibitor; sire, "Sir Peregrine;" dam, "Nancy;" sire of dam, "Duke."

CHARLES HAMBRO, Milton Abbey, Blandford, Dorsetshire: **SECOND PRIZE**, 10*l.*, for "Miss Portman," red, 2 years 8 months 1 week-old, in calf; bred by Lord Portman, Bryanston, Blandford, Dorsetshire; sire, "Royal George;" dam, "Milkmaid;" sire of dam, "Royal George."

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MAJOR-GENERAL THE HON. A. NELSON HOOD, Cumberland Lodge, Windsor, Berkshire: FIRST PRIZE, 15*l.*, for "Rose of Denmark," red, 1 year 11 months-old; bred by exhibitor; sire, "Colonel" (387); dam, "Fancy" (703); sire of dam, "William."

GEORGE TURNER, Beacon Downes, Exeter, Devon: SECOND PRIZE, 10*l.*, for "Lady Audley," red, 1 year 9 months 3 weeks-old; bred by exhibitor; sire, "The Little Known;" dam, "Fanny Fern;" sire of dam, "West Australian."

MAJOR-GENERAL THE HON. A. NELSON HOOD: the *Reserved Number*, to "Princess Louise," red, 1 year 7 months 4 weeks-old; bred by exhibitor; sire, "Saracen" (520*a*); dam, "Sweetbriar" (1665); sire of dam, "Zouave" (556).

WALTER FARTHING, Stowey Court, Bridgewater, Somersetshire: FIRST PRIZE, 10*l.*, for red, 8 months 1 week 3 days-old; bred by exhibitor; sire, "Viscount;" dam, "Julia;" sire of dam, "Lord Quantock."

*Sussex Bulls.*

GEORGE JENNER, Parsonage House, Udimore, Rye, Sussex: FIRST PRIZE, 10*l.*, for "The Earl" (96), red, 3 years 5 months-old; bred by Messrs. Heasman, Angmering, Arundel, Sussex; sire, "Marquis" (16); dam, "Countess" (30).

WILLIAM MARSHALL, Bolney Place, Cuckfield, Sussex: SECOND PRIZE, 5*l.*, for "Marmaduke," red, under 6 years-old; bred by E. Cane, Esq., Berwick Court, Lewes, Sussex; sire, "Unicorn;" dam, "Brandy;" sire of dam, "Gorringe."

*Sussex Cows and Heifers.*

GEORGE JENNER, Parsonage House, Udimore, Rye, Sussex: FIRST PRIZE, 10*l.*, for "Mayflower" (350), red, 7 years 4 months-old, in-milk and in-calf; bred by exhibitor; sire, "Stonham Bull;" dam, "Longford Cow."

WILLIAM MARSHALL, Manor House, Bolney, Cuckfield, Sussex: SECOND PRIZE, 5*l.*, for "Frost," red, 6 years, 5 months 3 weeks 3 days-old, in-milk; bred by exhibitor; sire, "Sultan;" dam, "Fill-pail."

GEORGE JENNER: the *Reserved Number*, for "Bishop" (635), red, 4 years 5 months-old, in-milk and in-calf; bred by exhibitor; sire, "Challenger" (33); dam, "Bishop Cow;" sire of dam, "Knell Bull."

WILLIAM MARSHALL, Manor House, Bolney, Cuckfield, Sussex: FIRST PRIZE, 10*l.*, for "Helen," red, 2 years 8 months 1 week-old, in-calf; bred by exhibitor; sire, "Havelock;" dam, "Hester;" sire of dam, "Chichester."

GEORGE JENNER, Parsonage House, Udimore, Rye, Sussex: SECOND PRIZE, 5*l.*, for "Mayflower Twin No. 1," red, 2 years 4 months 1 week 3 days-old, in-calf; bred by exhibitor; sire, "Challenger" (33); dam, "Mayflower" (350); sire of dam, "Stonham Bull."

WILLIAM MARSHALL: the *Reserved Number*, to his red, 2 years 8 months-old, in-calf; bred by exhibitor; sire, "Havelock;" dam, "Fill-pail;" sire of dam, "Chichester."

GEORGE JENNER, Parsonage House, Udimore, Rye, Sussex, FIRST PRIZE, 10*l.*, for "Selmes Heifer," red, 1 year, 5 months 2 weeks 3 days-old; bred by exhibitor; sire, "Challenger" (33); dam, "Selmes Cow;" sire of dam, "Stonham Bull."

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GEORGE JENNER: SECOND PRIZE, 5*l.*, for "Princess," red, 1 year 3 months-old; bred by exhibitor; sire, "Challenger" (33); dam, "Princess;" sire of dam, "Stonham Bull."

WILLIAM MARSHALL, Manor House, Bolney, Cuckfield, Sussex: the *Reserved Number*, to his red, 1 year 7 months 2 weeks 3 days-old; bred by exhibitor; sire, "Prince Alfred;" dam, "Fanny;" sire of dam, "Have-lock."

### *Channel Islands Bulls.*

JAMES DUMBRELL, Ditchling, Hurstperpoint, Sussex: FIRST PRIZE, 10*l.*, for "King Charming," light grey, 2 years 6 months-old (Jersey); bred by Mr. Labey, Jersey; sire, "Prince Albert."

JAMES DUMBRELL: SECOND PRIZE, 5*l.*, for "Prince Arthur," grey and tan, 1 year 3 months 1 week 5 days-old (Jersey); bred by exhibitor; sire, "St. Helier;" dam, "Myrtle."

JAMES DUMBRELL: the *Reserved Number*, to "Wickham," dark grey and tan, 2 years 5 months-old (Jersey); bred by Mr. J. Labey, Grouville, Jersey.

### *Channel Islands Cows and Heifers.*

JAMES DUMBRELL: FIRST PRIZE, 10*l.*, for "Lavender," grey and white, about 8 years-old (Jersey), in-calf; bred by M. Gibot, Jersey.

LAWRENCE FOWLER, Little Bushey Farm, Watford, Herts: SECOND PRIZE, 5*l.*, for "Primrose," red and white, 4 years 11 months-old (Jersey), in-milk and in-calf; bred by Mr. Aubin, St. Saviour's, Jersey.

THOMAS WILSON, Shotley Hall, Shotley Bridge, Gateshead, Northumberland: THIRD PRIZE, Silver Medal, for fawn and white, 8 years-old (Alderney), in-milk and in-calf; bred by Mr. Fowler.

RICHARD EASTWOOD, Thorney Holme, Clitheroe, Lancashire: the *Reserved Number*, to "Tit," fawn and white, 4 years-old (Channel Islands), in-milk; breeder unknown.

JAMES DUMBRELL, Ditchling, Hurstperpoint, Sussex: FIRST PRIZE, 10*l.*, for "Geranium," lemon and white, 2 years 5 months-old (Jersey), in-calf; bred by exhibitor; sire, "Prince Peacock."

JAMES DUMBRELL: SECOND PRIZE, 5*l.*, for "Cowslip," lemon and white, 2 years 10 months-old (Jersey), in-calf; bred by exhibitor; sire, "Peacock;" dam, "Lemon."

### *Ayrshire Bulls.*

JOHN STEWART, Burnside Cottage, Strathaven, Lanarkshire: FIRST PRIZE, 20*l.*, for "Defiance," white and brown, 2 years 2 months 3 weeks-old; bred by Matthew Gilmour, Gree, Berth, Ayrshire.

JOHN STEWART: SECOND PRIZE, 10*l.*, for "Marquis," white and dark brown, 2 years 2 months 2 weeks-old; bred by Robert M'Kean, Lumloch, Cadder, Lanarkshire; sire, "Sir Colin."

WILLIAM SCOTT, Cranberry, Ecclefechan, Dumfriesshire: FIRST PRIZE, 20*l.*, "Sir Walter Scott," white roan, 1 year 4 months-old; bred by exhibitor; sire, "Sir Colin 2nd;" dam, "Swanie;" sire of dam, "Jack."

THE DUKE OF HAMILTON AND BRANDON, Hamilton Palace, Hamilton, Lanarkshire: SECOND PRIZE, 10*l.*, for his white and red, 1 year 2 months-old; bred by exhibitor.

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THE DUKE OF HAMILTON AND BRANDON: the *Reserved Number*, to his red and white, 1 year 2 months-old; bred by Lawrence Drew, Merryton, Hamilton, Lanarkshire.

*Ayrshire Cows and Heifers.*

THE DUKE OF HAMILTON AND BRANDON: FIRST PRIZE, 15*l.*, for "Park," white and red, 3 years 1 month-old, in-calf; bred by Lawrence Drew, Merryton, Hamilton, Lanarkshire.

THE DUKE OF HAMILTON AND BRANDON: SECOND PRIZE, 5*l.*, for his black, 3 years 2 months-old, in-milk; breeder unknown.

THE DUKE OF HAMILTON AND BRANDON: the *Reserved Number*, to "Scott," red and white, 4 years 2 months-old, in-calf; bred by Lawrence Drew, Merryton, Hamilton, Lanarkshire.

THE DUKE OF HAMILTON AND BRANDON: FIRST PRIZE, 10*l.*, for "Castleton," red and white, 2 years-old, in-calf; bred by Lawrence Drew, Merryton, Hamilton.

THE DUKE OF HAMILTON AND BRANDON: SECOND PRIZE, 5*l.*, for "Rutherglen," white and red, 2 years 2 months-old, in-calf; bred by Lawrence Drew, Merryton, Hamilton.

JOHN STEWART, Burnside Cottage, Strathaven, Lanarkshire: the *Reserved Number*, to "Beauty," flecked, 2 years 2 months 2 weeks-old, in-calf; bred by James Logan, Stonyholme, Kilbirnie, Ayrshire.

THE DUKE OF HAMILTON AND BRANDON: FIRST PRIZE, 10*l.*, for "Castleton," white and red, 1 year 2 months-old; bred by exhibitor.

THE DUKE OF HAMILTON AND BRANDON: SECOND PRIZE, 5*l.*, for "Airblaes," white and red, 1 year 1 month-old; bred by exhibitor.

JOHN STEWART, Burnside Cottage, Strathaven, Lanarkshire: the *Reserved Number*, to "Broom," white with light brown, 1 year 2 months-old; bred by Robert Kerr, Broom, Mearns, Renfrewshire.

*Scotch Polled Bulls—except Galloways.*

ROBERT WALKER, Hillside House, Portlethen, Aberdeen: FIRST PRIZE, 20*l.*, for "Foxmaule" (305), black, 5 years 1 month 6 days old (Scotch polled); bred by exhibitor; sire, "Marquis," (212); dam, "Matilda Fox" (302); sire of dam, "Cupbearer" (59).

ALEXANDER PATERSON, Mulben, Blackhillock-by-Keith, Co. Elgin: SECOND PRIZE, 10*l.*, for "Prince of Wales," black, 4 years 4 months 3 weeks 5 days-old (Scotch polled); bred by George Brown, Watertown, Fochabers, Elgin; sire, "Prince Albert;" dam, "Kate."

WILLIAM M'COMBIE, Tillyfour, Aberdeen: FIRST PRIZE, 20*l.*, for his black, 1 year 5 months-old (Angus polled); bred by exhibitor; sire, "Black Prince;" dam, "Charlotte;" sire of dam, "Angus."

*Scotch Polled Cows and Heifers—except Galloways.*

WILLIAM M'COMBIE: FIRST PRIZE, 15*l.*, for his "Pride of Aberdeen," black, 8 years 5 months-old (Angus polled), in-milk; bred by exhibitor; sire, "Hanton;" dam, "Charlotte;" sire of dam, "Angus."

WILLIAM M'COMBIE: SECOND PRIZE, 5*l.*, for his "Charlotte," black, 13 years 5 months-old (Angus polled), in-milk; bred by exhibitor; sire, "Angus;" dam, "Lola Montes;" sire of dam, "Monarch."



**WILLIAM M'COMBIE**: FIRST PRIZE, 10*l.*, for his black, 2 years 5 months-old (Angus polled), in-calf; bred by exhibitor.

**WILLIAM M'COMBIE**: SECOND PRIZE, 5*l.*, for his black, 2 years 5 months-old (Angus polled), in-calf; bred by the Trustees of the late Mr. Scott, Ballylo, Brechin, Forfar.

**WILLIAM M'COMBIE**: FIRST PRIZE, 10*l.*, for his black, 1 year 4 months-old (Angus polled); bred by exhibitor.

**WILLIAM M'COMBIE**: SECOND PRIZE, 5*l.*, for his black, 1 year 5 months-old (Aberdeen and Angus polled); bred by exhibitor.

**LORD KINNAIRD**, Rossie Priory, Inchture, Perthshire, the *Reserved Number*, to "Binn's Delight," black, 1 year, 2 months 1 week 3 days-old (Polled Angus); bred by William Watson, Binns, Dundee; sire, "Hugh 2nd;" dam, "Binn's Blossom;" sire of dam, "President 2nd."

### *Scotch Horned Bulls.*

**THE DUKE OF ATHOLE**, Blair Castle, Blair Athole, Perthshire: FIRST PRIZE, 20*l.*, for his red, 3 years 2 months 2 weeks-old (West Highland); bred by the late Marquis of Breadalbane, Taymouth Castle, Aberfeldy, Perthshire.

**VISCOUNT BOYNE**, Brancepeth Castle, Durham: SECOND PRIZE, 10*l.*, for his cream, 4 years 2 months-old (West Highland); bred by exhibitor.

**THE DUKE OF ATHOLE**, Blair Castle, Blair Athole, Perthshire: FIRST PRIZE, 20*l.*, for "Gille Dubh," black, 1 year 4 months 2 weeks 5 days-old (West Highland); bred by exhibitor; dam, "Dubh Chiar."

**THE DUKE OF ATHOLE**: SECOND PRIZE, 10*l.*, for "Oscar," brindled, 1 year 5 months 3 weeks 5 days-old (West Highland); bred by exhibitor.

### *Scotch Horned Cows and Heifers.*

**THE DUKE OF ATHOLE**: FIRST PRIZE, 15*l.*, for "Rosie," red, 7 years 4 months-old (West Highland), in-milk; bred by the late Marquis of Breadalbane, Taymouth Castle, Aberfeldy, Perthshire.

**THE DUKE OF ATHOLE**: SECOND PRIZE, 5*l.*, for "Emily," brindled, 6 years 1 month 1 week 4 days-old (West Highland), in-milk; bred by the late Marquis of Breadalbane, Taymouth Castle, Aberfeldy, Perthshire; dam, "Beauty."

**WILLIAM POTTS**, Crook, Rothbury, Northumberland: the *Reserved Number*, to his dun, 4 years 8 months-old, in-milk; breeder unknown.

### *Bulls of other Established Breeds.*

**LORD SONDES**, Elmham Hall, Thetford, Norfolk: FIRST PRIZE, 10*l.*, for "Rufus," red, 3 years 8 months-old (Norfolk polled); bred by T. W. George, Eaton, Norwich.

**SIR EDWARD KERRISON**, Bart., M.P., Brome Hall, Scole, Suffolk: SECOND PRIZE, 5*l.*, for "Eclipse," red, 3 years 4 months 4 days-old (Suffolk polled); bred by Samuel Wolton, Newbourn Hall, Woodbridge, Suffolk; sire, "Nonpareil;" dam, "Cossett."

**BARNABAS COLLINS**, Hunston, Ixworth, Suffolk: FIRST PRIZE, 10*l.*, for "Richard I.," red, 3 years 4 months 4 days-old (Suffolk); bred by exhibitor; sire, "Nelson;" dam, "Cherry."

**LORD SONDES**, Elmham Hall, Thetford, Norfolk: SECOND PRIZE, 5*l.*, for "Red Jacket 4th," red, 1 year 9 months-old (Norfolk polled); bred by James Nicholson, Grassenhall, Dereham, Norfolk.

*Cows and Heifers of other Established Breeds.*

- LORD SONDES : FIRST PRIZE, 10*l.*, for "Fillpail," red, 5 years-old (Norfolk polled), in-milk and in-calf ; bred by John Davey, Necton, Shipdham, Norfolk.
- LORD SONDES : SECOND PRIZE, 5*l.*, for "Crocus," red, 7 years 1 month-old (Norfolk polled), in-milk and in-calf ; bred by exhibitor.
- SIR WILLOUGHBY JONES, Bart., Cranmer Hall, Fakenham, Norfolk : THIRD PRIZE, Silver Medal, for "Buttercup," red, 3 years 2 months 3 weeks 4 days-old (Norfolk red polled), in-calf ; bred by Robert Thompson, Barningham, Thetford, Norfolk.
- SIR EDWARD KERRISON, Bart., M.P., Brome Hall, Scole, Suffolk : the *Reserved Number*, to "Oakly," red, 8 years-old (Norfolk polled), in-milk and in-calf ; breeder unknown.
- LORD SONDES, Elmham Hall, Thetford : FIRST PRIZE, 10*l.*, for "Cherry," red, 2 years 7 months-old (Norfolk polled), in-calf ; bred by exhibitor.
- SIR WILLOUGHBY JONES, Bart., Cranmer Hall, Fakenham : SECOND PRIZE, 5*l.*, for "Sweetbriar," red, 2 years 3 months-old (Norfolk polled), in-calf ; bred by exhibitor ; sire, "Red Jacket ;" dam, "Cherry."
- LORD SONDES, Elmham Hall, Thetford : the *Reserved Number*, to "Pink," 2 years 6 months-old (Norfolk polled), in-calf ; bred by exhibitor.
- BARNABAS COLLINS, Hunston, Ixworth, Suffolk : FIRST PRIZE, 10*l.*, for "Princess," blood red, 1 year 4 months 3 days-old (Suffolk) ; bred by exhibitor ; sire, "Sammy ;" dam, "Rose ;" sire of dam, "Red Rover."
- SIR WILLOUGHBY JONES, Bart., Cranmer Hall, Fakenham : SECOND PRIZE, 5*l.*, for "Bijou," red, 1 year 1 month 1 week 3 days-old (Norfolk red polled) ; bred by Stephen Leeds, North Barsham, Fakenham, Norfolk.
- LORD SONDES, Elmham Hall, Thetford : the *Reserved Number*, to "Bell," red, 1 year 8 months-old (Norfolk polled) ; bred by exhibitor.

## HORSES.

*Thorough-bred Stud Horses.*

- CHARLES and JAMES MOFFITT, Kirklington Park, Carlisle, Cumberland : FIRST PRIZE, 100*l.*, for "Laughingstock," bay, 5 years-old ; bred by Sir Charles Monck, Belsay Castle, Newcastle-on-Tyne ; sire, "Stockwell ;" dam, "Gaiety ;" sire of dam, Touchstone."
- EDWARD GEORGE SIMPSON, Levent Bridge, Yarm, Yorkshire : SECOND PRIZE, 25*l.*, for "Cavendish," brown, 8 years-old ; bred by William Robinson, Richmond, Yorkshire ; sire, "Voltigeur ;" dam, "Countess of Burlington ;" sire of dam, "Touchstone."
- SIR CHARLES M. L. MONCK, Belsay, Newcastle-on-Tyne : the *Reserved Number*, to "Gamester," bay, 8 years-old ; bred by exhibitor ; sire, "The Cossack ;" dam, "Gaiety ;" sire of dam, "Touchstone."

*Hunter Stallions.*

- JOSEPH CASSON, Middleton Lodge, Uphall Edinburgh : FIRST PRIZE, 25*l.*, for "Mottley," brown, 12 years-old ; bred by Mr. Rickaby (address unknown) ; sire, "Touchstone ;" dam, "Lanercost Mare ;" sire of dam, "Lanercost."

*Hunter Brood Mares.*

JOHN BROWN, Wiggonby, Wigton, Cumberland: FIRST PRIZE, 15*l.*, for "Sally," bay, 12 years-old (with foal at foot); bred by Mr. Chambers, Pelutho, Wigton; sire, "Galaor;" dam, "Madame;" sire of dam, "Retriever."

WILLIAM T. SCARTH, Keverstone Grange, Darlington: SECOND PRIZE, 10*l.*, for "Plucky," brown, 19 years-old (with foal at foot); bred by Mr. Ran, Piercebridge, Darlington; sire, "Nimrod;" sire of dam, "Curtius."

CHARLES MOFFATT, Crosby-on-Eden, Carlisle: the *Reserved Number*, to his brown, 13 years-old (in foal); bred by John Chambers, Pelutho, Abbey Holme, Cumberland; sire, "Galaor;" sire of dam, "Retriever."

*Hackney Brood Mares.*

RICHARD BRITTON, Leeds Pottery, Leeds: FIRST PRIZE, 15*l.*, for "Fanny," black, 12 years-old (with foal at foot); breeder unknown.

FRANCIS COOK, Thixendale, Malton, Yorkshire: SECOND PRIZE, 10*l.*, for "The British Queen," bay, 6 years-old (in foal); bred by exhibitor; sire, "British Champion;" dam, "Evening Star;" sire of dam, "Cook's Wildfire."

*Pony Stallions.*

ROBERT NORMAN and SON, High Close, Aspatria, Cumberland: FIRST PRIZE, 15*l.*, for "Jack," chesnut, 4 years-old; bred by exhibitors; sire, "Potentate;" dam, "Jessie."

WILLIAM and STEPHEN HODGSON, Rodderup, Penrith Alstan, Cumberland: SECOND PRIZE, 5*l.*, for "Glengarry," dark bay, 9 years-old; bred by Mr. Graham, Bald Howe, Matterdale, Cumberland; sire, "Mountain Ranger."

*Pony Mares.*

GEORGE HEPPEL RAMSAY, Derwent Villa, Newcastle: FIRST PRIZE, 10*l.*, for "Beauty," grey, 8 years-old; bred by the Rev. Mr. Bird, Chatterton, Hexham, Northumberland.

GEORGE HEPPEL RAMSAY: SECOND PRIZE, 5*l.*, for "My Lady," grey, 6 years-old; breeder unknown.

*Agricultural Stallions not qualified to compete as Suffolks or Clydesdales.*

SAMUEL STRICKLAND, Headley Hall, Tadcaster, Yorkshire: FIRST PRIZE, 20*l.*, for "Lincolnshire," brown, 6 years-old; breeder unknown; sire, "Young Waxwork;" sire of dam, "Ploughboy."

MATTHEW REED, Beamish Burn, Chester-le-Street, Durham: SECOND PRIZE, 10*l.*, for "England's Glory," bay, 8 years-old; bred by W. Pank, Borough Fen, Northamptonshire; sire, "England's Glory;" dam, "Sweep;" sire of dam, "Thumper."

ROBERT ORANGE, Bedlington, Northumberland: THIRD PRIZE, Silver Medal, for "Conqueror," grey, 3 years-old; bred by Mr. Lilburn, Preston, North Shields; sire, "Young Conqueror;" sire of dam, "Industry."

THOMAS and SAMUEL FYSON, Warboys, Hunts.: the *Reserved Number*, to "Young England's Glory," bay, 4 years-old; bred by exhibitors; sire, "England's Glory;" dam, "Lightsome."

lii     *Award of Live-Stock Prizes at Newcastle-upon-Tyne.*

- SAMUEL STRICKLAND, Headley Hall, Tadcaster, Yorkshire : FIRST PRIZE, 15*l.*, for "General Garibaldi," roan chesnut, 2 years-old ; bred by exhibitor ; sire, "Sampson ;" dam, "Blossom ;" sire of dam, "Great Britton."
- JOHN HENDERSON, Hossley Hill, South Shields : SECOND PRIZE, 10*l.*, for "Victor," bay, 2 years-old ; bred by exhibitor ; sire, "England's Glory ;" dam, "Damsel ;" sire of dam, "Farmer's Glory."
- THOMAS IRWIN, High Spen, Winlaton, Durham : the *Reserved Number*, to "Emulator," dark bay, 2 years-old ; bred by William Johnson, Danial, Ryton, Durham ; sire, "Young Sampson."

*Agricultural Mares and Foals not qualified to compete as Suffolks or Clydesdales.*

- JOHN B. DIXON, Hollings Farm, Ebchester, Northumberland : FIRST PRIZE, 20*l.*, for "Jolly," dark brown, 18 years-old ; bred by John Dixon, Broad Oak, Ebchester ; sire, "Nelson Ball ;" dam, "Blossom ;" sire of dam, "Raven."
- SAMUEL THOMPSON, Peel Hall Farm, Skipworth, Selby, Yorkshire : SECOND PRIZE, 10*l.*, for "Diamond," black, 5 years-old ; bred by exhibitor ; sire, "Black Douglas ;" dam, "Darby ;" sire of dam, "Little John."
- JONATHAN M. PATTISON, Norwood, Gateshead : the *Reserved Number*, to "Jolly," bay, 4 years-old ; bred by exhibitor ; sire, "England's Glory ;" dam, "Jolly ;" sire of dam, "Wallace."

*Agricultural Fillies not qualified to compete as Suffolks or Clydesdales.*

- JOHN EDEN, Beamish Park, Fence Houses, Durham : FIRST PRIZE, 15*l.*, for "Beauty," bay, 2 years-old ; bred by exhibitor ; sire, "England's Glory ;" dam, "Damsel ;" sire of dam, "Wallace."
- MATTHEW REED, Beamish Burn, Chester-le-Street, Durham : FIRST PRIZE, 15*l.*, for "George 2nd," grey, 14 years-old ; bred by Mr. Dodd, Byfield, Northampton ; sire, "Brown George."

*Dray Stallions.*

- WILLIAM DICKMAN, Lumley, Fence Houses, Durham : FIRST PRIZE, 20*l.*, for "Young England," grey, 2 years-old ; bred by exhibitor ; sire, "England's Glory ;" dam, "Nonpareil."

*Dray Mares and Foals.*

- WILLIAM DICKMAN : FIRST PRIZE, 15*l.*, for his grey, 6 years-old ; bred by exhibitor ; sire, "Nonpareil."

*Suffolk Stallions.*

- EDMUND COTTINGHAM, Dunningworth Hall, Saxmundham, Suffolk : FIRST PRIZE, 20*l.*, for "Talbot," chesnut, 4 years-old ; bred by J. G. Sheppard, Campsey Ashe, Wickham Market, Suffolk ; sire, "Capon's Duke ;" dam, "Doughty ;" sire of dam, "Ajax."
- CHARLES BOBY, Alton Hall, Stutton, Ipswich : SECOND PRIZE, 10*l.*, for "Conqueror," chesnut, 5 years-old ; bred by exhibitor ; sire, "Hero ;" sire of dam, "Old Briton."
- HENRY GILES, Croxton Park, Thetford, Norfolk : FIRST PRIZE, 15*l.*, for "Ploughboy," chesnut, 2 years-old ; bred by exhibitor ; sire, "Boxer ;" dam, "Brock ;" sire of dam, "Prince."



WILLIAM THOMPSON, junr., Rose Cottage, Thorpe, Colchester, Essex : SECOND PRIZE, 10*l.*, for "Garibaldi," chesnut, 2 years-old ; bred by exhibitor ; dam, "Brock."

*Suffolk Mares and Foals.*

SIR T. B. LENNARD, Bart., Belhus, Aveley, Romford, Essex : FIRST PRIZE, 20*l.*, for "Canterbury Nun," chesnut, 6 years-old ; bred by Mr. Buck, Creetingham, Wickham Market, Suffolk ; sire, "The Hero ;" sire of dam, "Captain."

SIR EDWARD KERRISON, Bart., M.P., Brome Hall, Scole, Suffolk : SECOND PRIZE, 10*l.*, for "Lady Jane," chesnut, 5 years-old ; breeder unknown.

*Clydesdale Stallions.*

ANTHONY GRIERSON, Kelhead, Annan, Dumfriesshire : FIRST PRIZE, 20*l.*, for "The Benecia Boy," bay, 5 years-old ; bred by Robert Lohead, Glenshinnoch, Bishopton, Paisley, Renfrewshire ; sire, "Young Sampson ;" sire of dam, "Prince Royal."

DAVID RIDDLE, Kilhourie, Duntocher, Dumbartonshire : FIRST PRIZE, 15*l.*, for "Young Sir Walter Scott," dark bay, 2 years-old ; bred by William Moffat, Shirna, Kirkintilloch, Dumbartonshire ; sire, "Sir Walter Scott ;" dam, "Jessie."

ROBERT MOFFAT, Dormansteads, Stapleton, Brampton, Cumberland : SECOND PRIZE, 10*l.*, for "Clyde," brown, 2 years-old ; bred by Messrs. Bell, Nook Erthington, Brampton, Cumberland ; sire, "Lofty ;" sire of dam, "Young Clyde."

*Clydesdale Mares and Foals.*

JAMES MARR, Alderstone, Mid Calder, Midlothian : FIRST PRIZE, 20*l.*, for "Jess," brown, 7 years-old ; breeder unknown.

JOHN MUIR, Lockfergus, Kirkcudbright : SECOND PRIZE, 10*l.*, for "Rosy," grey, 7 years-old ; bred by Mr. Pattie, Dalriskan, Dumfries ; sire, "Lord Byron ;" dam, "Rosy."

*Clydesdale Fillies.*

THE DUKE OF HAMILTON AND BRANDON, Hamilton Palace, Hamilton, Lanarkshire : FIRST PRIZE, 15*l.*, for his bay, 2 years-old ; bred by John Barr, Barangray, Bishoptown, Renfrewshire ; sire, "Garibaldi ;" dam, "Darling."

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SHEEP.

*Leicester Rams.*

JOHN BORTON, Barton House, Malton, Yorkshire : FIRST PRIZE, 20*l.*, for his 1 year 3 months-old ; bred by exhibitor.

THOMAS EDWARD PAWLETT, Beeston, Sandy, Beds : SECOND PRIZE, 10*l.*, for his 1 year 3 months-old ; bred by exhibitor.

LIEUTENANT-COLONEL WILLIAM INGE, Thorpe Constantine, Tamworth, Staffordshire : THIRD PRIZE, Silver Medal, for his 1 year 4 months-old ; bred by exhibitor ; sire, "C. N."

liv     *Award of Live-Stock Prizes at Newcastle-upon-Tyne.*

JOHN BORTON, Barton House, Malton, Yorkshire: the *Reserved Number*, to his 1 year 3 months-old; bred by exhibitor.

ROBERT WARD CRESWELL, Ravenstone, Ashby-de-la-Zouch, Leicestershire: FIRST PRIZE, 20*l.*, for his 3 years 4 months-old; bred by exhibitor.

ROBERT WARD CRESWELL, SECOND PRIZE, 10*l.*, for his 3 years 4 months-old; bred by exhibitor.

GEORGE TURNER, Beacon Downes, Exeter, Devonshire: THIRD PRIZE, Silver Medal, for his 3 years 4 months-old; bred by exhibitor.

GEORGE TURNER, the *Reserved Number*, to his 2 years 4 months-old; bred by exhibitor.

*Leicester Ewes—Pens of Five.*

SAMUEL WILEY, Brandsby, York: FIRST PRIZE, 15*l.*, for his about 1 year 3 months-old; bred by exhibitor.

LIEUTENANT-COLONEL WILLIAM INGE, Thorpe Constantine, Tamworth: SECOND PRIZE, 10*l.*, for his 1 year 4 months-old; bred by exhibitor; sire, "C. N."

THOMAS MARRIS, The Chase, Ulceby, Lincolnshire: the *Reserved Number*, to his 1 year 3 months 2 weeks-old; bred by exhibitor.

*Cotswold Rams.*

EDWARD HANDY, Sierford, Cheltenham, Gloucestershire: FIRST PRIZE, 20*l.*, for his 1 year 3 months 2 weeks-old; bred by exhibitor.

JOHN WELLS, Hampnett, Northleach, Gloucestershire: SECOND PRIZE, 10*l.*, for his 1 year 3 months 3 weeks-old; bred by exhibitor.

EDWARD HANDY, Sierford, Cheltenham: THIRD PRIZE, Silver Medal, for his 1 year 3 months 2 weeks-old; bred by exhibitor.

WILLIAM LANE, Bromfield Farm, Northleach, the *Reserved Number*, to his 1 year 3 months 2 weeks-old; bred by exhibitor.

THOMAS BEALE BROWNE, Salperton Park, Andoversford, Gloucestershire: FIRST PRIZE, 20*l.*, for his 4 years 3 months-old; bred by exhibitor.

WILLIAM LANE, Bromfield Farm, Northleach: SECOND PRIZE, 10*l.*, for his 3 years 4 months-old; bred by exhibitor.

THOMAS BEALE BROWNE, Salperton Park, Andoversford: THIRD PRIZE, Silver Medal, for his 3 years 3 months-old; bred by exhibitor.

WILLIAM LANE, Bromfield Farm, Northleach: the *Reserved Number*, to his 3 years 3 months-old; bred by exhibitor.

*Cotswold Ewes—Pens of Five.*

JOHN WELLS, Hampnett, Northleach: FIRST PRIZE, 15*l.*, for his 1 year 3 months 2 weeks old; bred by exhibitor.

WILLIAM LANE, Bromfield Farm, Northleach: SECOND PRIZE, 10*l.*, for his 1 year 3 months-old; bred by exhibitor.

WILLIAM LANE, the *Reserved Number*, to his 1 year 3 months-old; bred by exhibitor.

*Lincoln and other Long-woolled Rams.*

ROBERT WRIGHT, Nocton Heath, Nocton, Lincolnshire: FIRST PRIZE, 20*l.*, for his 1 year 3 months 3 weeks-old; bred by exhibitor.

ROBERT WRIGHT: SECOND PRIZE, 10*l.*, for his 1 year 3 months 3 weeks-old; bred by exhibitor.

## *Award of Live-Stock Prizes at Newcastle-upon-Tyne.*      **lv**

- JOHN LYNN, Church Farm, Stroxtun, Grantham, Lincolnshire: **THIRD PRIZE**, Silver Medal, for his 1 year 4 months-old; bred by exhibitor; sire, "Battersea Royal."
- THOMAS BUMPSTEAD MARSHALL, Branston, Lincoln: the *Reserved Number* to his 1 year 4 months-old; bred by exhibitor.
- THOMAS BUMPSTEAD MARSHALL: **FIRST PRIZE**, 20*l.*, for his 4 years 4 months-old; bred by exhibitor.
- THOMAS BUMPSTEAD MARSHALL: **SECOND PRIZE**, 10*l.*, for his 2 years 4 months-old; bred by exhibitor.
- ROBERT WRIGHT, Nocton Heath, Nocton, Lincolnshire: the *Reserved Number*, to his 3 years 3 months-old; bred by John Dixon, Harmston, Lincolnshire.

### *Lincoln and other Long-woolled Ewes—Pens of Five.*

- ROBERT GEORGE FREDERICK HOWARD, Temple Bruer, Lincoln: **FIRST PRIZE**, 15*l.*, for his 1 year 4 months-old; bred by exhibitor.
- THOMAS BUMPSTEAD MARSHALL, Branston, Lincoln: **SECOND PRIZE**, 10*l.*, for his 1 year 4 months-old; bred by exhibitor.
- ROBERT GEORGE FREDERICK HOWARD, Temple Bruer, Lincoln: the *Reserved Number*, to his 1 year 4 months-old; bred by exhibitor.

### *Oxfordshire Down Rams.*

- GEORGE WALLIS, Old Shifford, Bampton, Faringdon, Oxfordshire: **FIRST PRIZE**, 20*l.*, for his 1 year 5 months 2 weeks-old; bred by exhibitor.
- GEORGE WALLIS: **SECOND PRIZE**, 10*l.*, for his 1 year 5 months 2 weeks-old; bred by exhibitor.
- GEORGE WALLIS: **THIRD PRIZE**, Silver Medal, for his 1 year 5 months 2 weeks-old; bred by exhibitor.
- JOHN BRYAN, Southleigh, Witney, Oxfordshire: the *Reserved Number*, to his 1 year 4 months-old; bred by exhibitor.
- GEORGE WALLIS: **FIRST PRIZE**, 20*l.*, for his 3 years 5 months 2 weeks-old; bred by exhibitor.
- GEORGE WALLIS: **SECOND PRIZE**, 10*l.*, for his 2 years 5 months, 2 weeks-old; bred by exhibitor.
- GEORGE WALLIS: the *Reserved Number*, to his 3 years 5 months 2 weeks-old; bred by exhibitor.

### *Oxfordshire Down Ewes—Pens of Five.*

- HENRY OVERMAN, Weasenham, Rougham, Norfolk: **FIRST PRIZE**, 15*l.*, for his 1 year 4 months 2 weeks-old; bred by exhibitor.
- THE DUKE OF MARLBOROUGH, Blenheim Palace, Woodstock, Oxfordshire: **SECOND PRIZE**, 10*l.*, for his 1 year 3 months 2 weeks-old; bred by exhibitor.
- The Executors of the late SAMUEL TREADWELL, Upper Winchendon, Waddesdon, Aylesbury, Buckinghamshire: the *Reserved Number*, to their about 1 year 5 months-old; bred by exhibitors.

### *South Down Rams.*

- LORD WALSINGHAM, Merton Hall, Thetford, Norfolk: **FIRST PRIZE**, 20*l.*, for his 1 year 4 months-old; bred by exhibitor.
- LORD WALSINGHAM: **SECOND PRIZE**, 10*l.*, for his 1 year 4 months-old; bred by exhibitor.

lvi     *Award of Live-Stock Prizes at Newcastle-upon-Tyne.*

- WILLIAM RIGDEN, Hove, Brighton: THIRD PRIZE, Silver Medal, for his 1 year 4 months-old; bred by exhibitor.
- LORD WALSLINGHAM: the *Reserved Number*, to his 1 year 4 months-old; bred by exhibitor.
- JOHN WATERS, Motcomb, Eastbourne, Sussex: FIRST PRIZE, 20*l.*, for his 2 years 3 months 2 weeks-old; bred by exhibitor.
- WILLIAM RIGDEN, Hove, Brighton: SECOND PRIZE, 10*l.*, for his 2 years 4 months-old; bred by exhibitor.
- THE DUKE OF RICHMOND, Goodwood, Chichester, Sussex: THIRD PRIZE, Silver Medal, for his 2 years 4 months-old; bred by exhibitor.
- THE EARL OF RADNOR, Coleshill House, Highworth, Wilts: the *Reserved Number*, to his 2 years 4 months-old; bred by exhibitor; sire, "Coleshill."

*South-Down Ewes—Pens of Five.*

- LORD WALSLINGHAM, Merton Hall, Thetford, Norfolk: FIRST PRIZE, 15*l.*, for his 1 year 4 months-old; bred by exhibitor.
- THE DUKE OF RICHMOND, Goodwood, Chichester, Sussex: SECOND PRIZE, 10*l.*, for his 1 year 4 months old; bred by exhibitor.
- THE EARL OF RADNOR, Coleshill House, Highworth: the *Reserved Number*, to his 1 year 4 months-old; bred by exhibitor; sire, "Battersea," dam, "Rigden's No. 5, 1862."

*Shropshire Rams.*

- EDWARD THORNTON, Pitchford, Shrewsbury, Shropshire: FIRST PRIZE, 20*l.*, for his 1 year 3 months 1 week-old; bred by exhibitor; sire, "Thornton," sire of dam, "Park Lord."
- HENRY MATTHEWS, Montford, Shrewsbury: SECOND PRIZE, 10*l.*, for his "Montford," 1 year 3 months 2 weeks-old; bred by exhibitor.
- JOHN COXON, Freeford, Lichfield, Staffordshire: THIRD PRIZE, Silver Medal, for his "Novelty," 1 year 3 months 2 weeks-old; bred by exhibitor; sire, "Nobleman."
- SAMPSON BYRD, The Lees Farm, Stafford: the *Reserved Number*, to his "Patentee 5th," 1 year 3 months 2 weeks-old; bred by exhibitor; sire, "Constitution;" sire of dam, "Patentee."
- JOHN COXON, Freeford, Lichfield, Staffordshire: FIRST PRIZE, 20*l.*, for his "Black Knight," 2 years 3 months 2 weeks-old; bred by exhibitor; sire, "Valiant the 2nd," sire of dam, "Lord Flash."
- PRYCE WILLIAM BOWEN, Shrawardine Castle, Shrewsbury: SECOND PRIZE, 10*l.*, for his 2 years 3 months 2 weeks-old; bred by exhibitor.
- JOSEPH SIMPSON, Spofforth Park, Wetherby, Yorkshire: the *Reserved Number*, to his 4 years 3 months 2 weeks-old; bred by Lord Wenlock.

*Shropshire Ewes—Pens of Five.*

- HENRY MATTHEWS, Montford, Shrewsbury: FIRST PRIZE, 15*l.*, for his 1 year 3 months 2 weeks-old; bred by exhibitor.
- HENRY SMITH, Sutton Maddock, Shiffnal, Shropshire: SECOND PRIZE, 10*l.*, for his 1 year 4 months 1 week-old; bred by exhibitor.
- EDWARD HOLLAND, Esq., M.P., Dumbleton Hall, Evesham, Gloucestershire: THIRD PRIZE, Silver Medal, for his 1 year 4 months-old; bred by exhibitor.



## *Award of Live-Stock Prizes at Newcastle-upon-Tyne.*    lvii

JAMES and EDWARD CRANE, Shrawardine, Shrewsbury : the *Reserved Number*, to their 1 year 3 months 1 week-old ; bred by exhibitors ; sire, "Celebrity the 2nd ;" sire of dam, "Jukes."

### *Hampshire and other Short-woolled Rams.*

WILLIAM BROWNE CANNING, Elston Hill, Devizes, Wiltshire : FIRST PRIZE, 20*l.*, for his 1 year 4 months 3 weeks-old ; bred by exhibitor.

STEPHEN KING, Bockhampton, Lambourne, Berkshire : SECOND PRIZE, 10*l.*, for his 1 year 4 months 2 weeks-old ; bred by exhibitor.

STEPHEN KING : the *Reserved Number* to his 1 year 4 months 2 weeks-old ; bred by exhibitor.

WILLIAM HUMFREY, Oak Ash, Chaddleworth, Wantage, Berkshire : FIRST PRIZE, 20*l.*, for his 2 years 5 months 2 weeks-old ; bred by exhibitor.

CHRISTOPHER ROSE, Zeals Green, Merc, Wiltshire : SECOND PRIZE, 10*l.*, for his 2 years 4 months 2 weeks 6 days-old ; bred by Mr. Waters, Stratford Subcastle, Salisbury, Wiltshire.

WILLIAM HUMFREY, Oak Ash, Chaddleworth, Wantage : the *Reserved Number* to his 2 years 5 months 1 week-old ; bred by exhibitor.

### *Hampshire and other Short-woolled Ewes—Pens of Five.*

WILLIAM BROWNE CANNING, Elston Hill, Devizes, Wiltshire : FIRST PRIZE, 15*l.*, for his 1 year 4 months 2 weeks-old ; bred by exhibitor.

WILLIAM HUMFREY, Oak Ash, Chaddleworth, Wantage : SECOND PRIZE, 10*l.*, for his 1 year 5 months-old ; bred by exhibitor.

STEPHEN KING, Bockhampton, Lambourne : the *Reserved Number*, to his 1 year 4 months 2 weeks-old ; bred by exhibitor.

### *Cheviot Rams.*

THOMAS ELLIOT, Hindhope, Jedburgh, Roxburghshire : FIRST PRIZE, 15*l.*, for his 1 year 2 months 3 weeks-old ; bred by exhibitor.

JOHN MCGREGOR, Riggheads, Lochmaben, Dumfries : SECOND PRIZE, 5*l.*, for his "Garibaldi," 1 year 2 months 3 weeks-old ; bred by exhibitor ; sire, "Hector ;" sire of dam, "Robinson."

ROBERT BORLAND, Auchincairn, Thornhill, Dumfries : THIRD PRIZE, Silver Medal, for his 1 year 3 months-old ; bred by exhibitor ; sire, "Perth ;" sire of dam, "Robson."

JAMES PATERSON, Terrona, Langholm, Dumfriesshire : the *Reserved Number*, to "Conservator," 1 year 2 months 2 weeks-old ; sire, "Thirlie."

JOHN ROBSON, Bymess, Rochester, Northumberland : FIRST PRIZE, 15*l.*, for "Nully," 2 years 3 months old ; bred by exhibitor ; sire, "Andrew."

JOHN ROBSON : SECOND PRIZE, 5*l.*, for "Johnny," 2 years 3 months-old ; bred by exhibitor ; sire, "Andrew."

JOHN ROBSON : the *Reserved Number*, to "Caffy," 2 years 3 months-old ; bred by exhibitor ; sire, "Andrew."

### *Cheviot Ewes—Pens of Five.*

ROBERT BORLAND, Auchincairn, Thornhill, Dumfries : FIRST PRIZE, 10*l.*, for his 1 year 3 months-old ; bred by exhibitor ; sire, "Perth ;" sire of dam, "Robson."

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THOMAS ELLIOT, Hindhope, Jedburgh, Roxburghshire : SECOND PRIZE, 5*l.*, for his 1 year 2 months 2 weeks-old ; bred by exhibitor.

ROBERT SHORTREED, Attonburn, Kelso, Roxburghshire : the *Reserved Number*, to his 1 year 2 months 2 weeks-old ; bred by exhibitor.

### *Blackfaced Rams.*

WILLIAM WARD, Forest Hall, Kendal, Westmoreland : FIRST PRIZE, 15*l.*, for his 1 year 2 months 2 weeks-old ; bred by exhibitor.

HENRY WALTON, Appletree Shield, West Allen, by Haydon Bridge, Northumberland : SECOND PRIZE, 5*l.*, for "the Bloom of the Hather," 1 year 2 months 2 weeks 6 days-old ; bred by Mr. White, Westburnhope, Hexhamshire, Northumberland ; sire, "The Pride of the Hather ;" sire of dam, "The King of the Mountain."

ALEXANDER WEARING LONG, Mint Cottage, Kendal, Westmoreland : the *Reserved Number*, to his 1 year 3 months-old ; bred by exhibitor.

WILLIAM WARD, Forest Hall, Kendal : FIRST PRIZE, 15*l.*, for his "Geordie," 5 years 2 months 2 weeks-old ; bred by George Hudson, Longsledale, Kendal, Westmoreland.

GEORGE HEDLEY, Otterstone Lee, Bellingham, Northumberland : SECOND PRIZE, 5*l.*, for his "Sultan," 5 years 3 months-old ; bred by John Roddam, of Newfold House, Allendale Town, Durham.

CHARLES SUMMERS, Whitfield, Haydon Bridge, Northumberland : the *Reserved Number* to his "Jock," 3 years 3 months-old ; bred by Mathew White, Westburnhope, Hexham, Northumberland.

### *Blackfaced Ewes—Pens of Five.*

CHRISTOPHER ARMSTRONG, Ashgillside, Alston, Cumberland : FIRST PRIZE, 10*l.*, for his 1 year 3 months-old ; bred by exhibitor.

JOHN AND WILLIAM DODD, Padaburn, Rosehill, Northumberland : SECOND PRIZE, 5*l.*, for their 1 year 2 months 5 days-old ; bred by exhibitors ; sire, "Scottish Chief."

WILLIAM WARD, Forest Hall, Kendal, Westmoreland : the *Reserved Number*, to his 1 year 2 months 2 weeks-old ; bred by exhibitor.

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## PIGS.

### *Boars of a Large White Breed.*

HENRY HARRISON, Cross Hills, Leeds, Yorkshire : FIRST PRIZE, 10*l.*, for "Young Hero," 1 year 10 months-old ; bred by exhibitor ; dam, "Lilydale."

RICHARD ELMHURST DUCKERING, Northorpe, Kirton Lindsey, Lincolnshire : SECOND PRIZE, 5*l.*, for "Victor," 2 years 10 months 3 weeks 4 days-old ; bred by John Harrison, Jun., Heaton Norris, Stockport, Lancashire ; sire, "Albert the 2nd or Samsom ;" dam, "Betsey."

JOHN HICKMAN, 21, Prospect-street, Hull, Yorkshire : the *Reserved Number*, to "Duke of York," about 2 years 10 months-old ; bred by R. Earl, Birmingham.

*Boars of a Small White Breed.*

GEORGE MANGLES, Givendale, Ripon, Yorkshire: FIRST PRIZE, 10*l.*, for "Brutus," 2 years 6 months 3 weeks-old (Yorkshire and Cumberland); bred by exhibitor; sire, "King of Diamonds;" dam, "Princess;" sire of dam, "Samuel."

THOMAS DUNLOP FINDLAY, Easterhill, Glasgow: SECOND PRIZE, 5*l.*, for "George I.," 2 years 8 months-old; bred by exhibitor; sire, "His Lordship;" dam, "Kate."

SAMUEL GEATER STEARN, Brandeston, Wickham Market, Suffolk: THIRD PRIZE, Silver Medal, for "Young Duke," 10 months 1 week 2 days-old (Suffolk), bred by exhibitor; sire, "Prince of Wales;" dam, "Victoria 2nd;" sire of dam, "Marquis."

WILLIAM PARKER, Golden Lion Inn, Leeds Road, Bradford, Yorkshire: the *Reserved Number*, to "Figaro," 1 year 6 months 2 weeks 4 days-old; bred by exhibitor.

*Boars of a Small Black Breed.*

GEORGE MUMFORD SEXTON, Wherstead Hall, Ipswich, Suffolk: FIRST PRIZE, 10*l.*, for "General Peel," 1 year 2 months 2 weeks 3 days-old (Suffolk); bred by exhibitor; sire, "Battersea Prince;" dam, "Bumptious 2nd;" sire of dam, "Terror."

GEORGE MUMFORD SEXTON: SECOND PRIZE, 5*l.*, for "Blair Athol," 1 year 1 month 2 weeks 3 days-old (Suffolk); bred by exhibitor; sire, "Battersea Prince;" dam, "Charmer;" sire of dam, "Shortnose."

LORD WENLOCK, Escrick Park, Yorkshire: the *Reserved Number*, to "Cannon Ball 2nd," 11 months-old; bred by exhibitor; sire, "Cannon Ball 1st."

*Boars of the Berkshire Breed.*

THE REV. HENRY G. BAILY, Swindon, Wilts.: FIRST PRIZE, 10*l.*, for his black, with a little white, 1 year 3 months 3 weeks 2 days-old; bred by exhibitor; sire, "Hannibal;" dam, "Empress;" sire of dam, "King of Gloucester."

THE REV. HENRY G. BAILY, SECOND PRIZE, 5*l.*, for "Governor," black, with a little white, 1 year 1 day-old; bred by exhibitor; sire, "Thomas Hogg," dam, "Rival Princess;" sire of dam, "King of Warwick."

ARTHUR STEWART, Saint Bridge, Gloucester: THIRD PRIZE, Silver Medal, for "Garibaldi," black, 7 months 1 week-old; bred by exhibitor; sire, "John."

GEORGE MANDER ALLENDER, Lee Grange, Winslow, Buckinghamshire: the *Reserved Number*, to "Brummagem Lad," black, 1 year 1 month-old; bred by exhibitor; sire, "Sir John;" dam, "Darkie."

*Boars of any other Breed.*

WILLIAM BRADLEY WAINMAN, Carhead, Cross Hills, Yorkshire: FIRST PRIZE, 10*l.*, for "Perfect Cure," white, 2 years 2 months-old (middle); bred by J. Palmer, of Skipton, Yorkshire; sire, "King Cube."

CHARLES WILLIAM GRAHAM, 1, Blackburn's Buildings, York-road, Leeds, Yorkshire: SECOND PRIZE, 5*l.*, for "Pride of Leeds," white, about 3 years-old (middle); bred by Mr. Rinder, of Sheepscar, Leeds; sire, "Cupid."

IX      *Award of Live-Stock Prizes at Newcastle-upon-Tyne.*

WILLIAM BRADLEY WAINMAN, Carhead, Cross Hills, Yorkshire: the *Reserved Number*, to "Bend Sinister," about 3 years-old (middle); breeder unknown.

*Breeding Sows of a Large White Breed.*

WILLIAM BRADLEY WAINMAN: FIRST PRIZE, 10*l.*, for "Rival Duchess," 3 years 4 days-old; bred by exhibitor.

WILLIAM BRADLEY WAINMAN: SECOND PRIZE, 5*l.*, for "Rival Hope," 2 years 10 months-old; breeder unknown.

JOHN HICKMAN, 21, Prospect-street, Hull: THIRD PRIZE; Silver Medal, for "Young Princess," 2 years 3 months 2 weeks-old; bred by exhibitor; sire, "Tom Pinch;" dam, "Princess;" sire of dam, "Old Duke."

STEPHEN BLAKEY, Westgate, Otley, Yorkshire: the *Reserved Number*, to "Lady Fitzwilliam," 2 years 6 months 2 weeks-old; bred by John Hartley, of Ilkley, Otley, Yorkshire; sire, "Wharfedale Hero;" dam, "Miller's Lass;" sire of dam, "Young Hector."

*Breeding Sows of a Small White Breed.*

WILLIAM BRADLEY WAINMAN, Carhead, Cross Hills, Yorkshire: FIRST PRIZE, 10*l.*, for "Silver Branch," 2 years 4 months 2 weeks-old; bred by Sir Charles R. Tempest, Bart., Broughton Hall, Skipton, Yorkshire; sire, "Carhead Oberon;" dam, "The Broughton Sow;" sire of dam, "Carhead Checkmate."

SAMUEL GEATER STEARN, Brandeston, Wickham Market, Suffolk: SECOND PRIZE, 5*l.*, for "Victoria 2nd," 2 years 2 months 3 weeks 2 days-old (Suffolk); bred by exhibitor; sire, "Marquis;" dam, "Victoria 1st;" sire of dam, "Duke."

THOMAS DUNLOP FINDLAY, Easter Hill, Glasgow: THIRD PRIZE, Silver Medal, for "Lady Emily," 1 year 4 months-old; bred by exhibitor; sire, "George the 1st;" dam, "Beauty."

WILLIAM HATTON, Addingham, Leeds: the *Reserved Number*, to "Young Reine de Flora," 1 year 1 month 2 weeks-old; bred by T. B. Stead, Leeds; sire, "Sir Colin;" dam, "Queen of the West."

*Breeding Sows of a Small Black Breed.*

GEORGE MUMFORD SEXTON, Wherstead Hall, Ipswich, Suffolk: FIRST PRIZE, 10*l.*, for "Breeze," 1 year 2 months 2 weeks 3 days-old (Suffolk); bred by exhibitor; sire, "Battersea Prince;" dam, "Bumptious;" sire of dam, "Terror."

SAMUEL GEATER STEARN, Brandeston, Wickham-Market, Suffolk: SECOND PRIZE, 5*l.*, for "Queen of Oude," 1 year 2 months 2 weeks 3 days-old (Suffolk); bred by exhibitor; sire, "Budd's Boar;" dam, "Gipsy Queen;" sire of dam, "Negro."

SAMUEL GEATER STEARN: THIRD PRIZE, Silver Medal, for "Aunt Chloe," 1 year 2 months 2 weeks 3 days-old (Suffolk); bred by exhibitor; sire, "Budd's Boar;" dam, "Gipsy Queen;" sire of dam, "Negro."

THOMAS CRISP, Butley Abbey, Wickham-Market: the *Reserved Number*, to his 1 year 11 months 1 week 5 days-old (Improved Suffolk); bred by exhibitor.



*Breeding Sows of the Berkshire Breed.*

ARTHUR STEWART, St. Bridge, Gloucester: FIRST PRIZE, 10*l.*, for "Dido," black, 1 year 2 months 1 week 1 day-old; bred by exhibitor; sire, "Tim Whiffler;" dam, "Aunt Sally;" sire of dam, "Tim the Blacksmith."

ARTHUR STEWART: SECOND PRIZE, 5*l.*, for "Mrs. Gamp," black; bred by exhibitor; sire, "Edward;" dam, "Lady Louisa;" sire of dam, "Duke of Gloucester."

GEORGE MANDER ALLENDER, Lee Grange, Winslow, Bucks: THIRD PRIZE, Silver Medal, for "Topsy," black, 1 year 10 months 5 days-old; bred by exhibitor; sire, "Glo'ster;" dam, "Darkie."

JOHN LYNCH FLETCHER, the Royal Agricultural College, Cirencester, Gloucestershire: the *Reserved Number*, to "Selina," black, with little white, 1 year 2 months 1 week 6 days-old; bred by R. A. College, Cirencester; sire, "Duke of Gloucester;" dam, "Stumpy."

*Breeding Sows of any other Breed.*

WILLIAM BRADLEY WAINMAN, Carhead, Cross Hills, Yorkshire: FIRST PRIZE, 10*l.*, for "Northern Garland," white, 2 years 7 months 3 weeks 1 day-old (Carhead middle).

WILLIAM BRADLEY WAINMAN: SECOND PRIZE, 5*l.*, for "The Happy Link," white, 2 years 7 months 1 week 6 days-old (Carhead middle); bred by exhibitor.

HENRY KEYWORTH, Woodhouse Moor, Leeds: THIRD PRIZE, Silver Medal, for "Dewdrop," white, 1 year 5 months 3 weeks-old (middle); bred by exhibitor; sire, "Pride of Leeds;" dam, "Lily of the Valley;" sire of dam, "Young Omer Pasha."

CHARLES WILLIAM GRAHAM, 1, Blackburn's Buildings, York Road, Leeds: the *Reserved Number*, to "Rose of the Valley," 2 year-old (middle); bred by William Howe, Union-street, Huddersfield, Yorkshire.

*Breeding Sow Pigs of a Large White Breed—Pens of Three.*

WILLIAM BRADLEY WAINMAN, Carhead, Cross Hills, Yorkshire: FIRST PRIZE, 10*l.*, for his white, 7 months 3 weeks 3 days-old (Carhead); bred by exhibitor.

JOHN HICKMAN, 21, Prospect-street, Hull: SECOND PRIZE, 5*l.*, for his white with blue spots, 7 months 3 days-old; bred by exhibitor; sire, "Garibaldi;" dam, "Young Princess;" sire of dam, "Tom Pinch."

RICHARD ELMSHIRST DUCKERING, Northorpe, Kirton Lindsey, Lincolnshire: the *Reserved Number*, to his white, 6 months 1 week 3 days-old; bred by exhibitor; sire, "Victor;" dam, "Beauty;" sire of dam, "Great Britain."

*Breeding Sow Pigs of a Small White Breed—Pens of Three.*

COLONEL THE HON. EDWARD G. D. PENNANT, M.P., Penrhyn Castle, Bangor, Carnarvonshire: FIRST PRIZE, 10*l.*, for his 7 months 3 weeks 3 days-old; bred by exhibitor; sire, "Lad;" dam, "Jessie;" sire of dam, "Dan."

LORD WENLOCK, Escrick Park, Yorkshire: SECOND PRIZE, 5*l.*, for his 7 months 2 weeks 3 days-old; bred by exhibitor; sire, "Cato 3rd;" dam, "Miss Kitty;" sire of dam "Farmer."

*Breeding Sow Pigs of a Small Black Breed—Pens of Three.*

GEORGE MUMFORD SEXTON, Wherstead Hall, Ipswich, Suffolk: FIRST PRIZE, 10*l.*, for "The Three Graces," black, 7 months-old (Suffolk); bred by exhibitor; sire, "Young Shortnose;" dam, "Battersea 1st Prize Sow;" sire of dam, "Negro."

SAMUEL GEATER STEARN, Brandeston, Wickham Market: SECOND PRIZE, 5*l.*, for his black, 5 months 2 weeks 1 day-old (Suffolk); bred by exhibitor; sire "Sambo;" dam, "Gipsy Queen;" sire of dam, "Negro."

*Breeding Sow Pigs of the Berkshire Breed—Pens of Three.*

JOHN KING TOMBS, Langford, Lechlade, Gloucestershire: FIRST PRIZE, 10*l.*, for his black and white, 7 months-old; bred by exhibitor.

JOSEPH DRUCE, Eynsham, Oxford: SECOND PRIZE, 5*l.*, for his black and white, 6 months 2 weeks 5 days-old; bred by exhibitor.

WILLIAM JAMES SADLER, Benthorne, Calcutt, Cricklade, Wiltshire: the *Reserved Number*, to his dark spotted, 7 months 2 weeks 5 days-old; bred by exhibitor; sire, "Mars;" dam, "Heavysides the 4th;" sire of dam, Rev. G. Bailey's "King of Warwick."

*Breeding Sow Pigs of any other Breed—Pens of Three.*

GEORGE MANGLES, Givendale, Ripon, Yorkshire: FIRST PRIZE, 10*l.*, for his white, 5 years 2 months 3 days-old (Yorkshire middle); bred by exhibitor.

JOSEPH WILSON, Manor House, Woodhorn, Morpeth, Northumberland: SECOND PRIZE, 5*l.*, for his white, 7 months 3 weeks 6 days-old (Improved Yorkshire); bred by exhibitor; sire, "Captain Cook;" dam, "Nanny;" sire of dam, "Peter the Great."

THOMAS RAMSAY, Sherburn Green, Gateshead: the *Reserved Number*, to his white, under 8 months old; bred by exhibitor; sire, "Willey Scott."

SPECIAL PRIZES GIVEN BY THE LOCAL COMMITTEE  
OF NEWCASTLE-UPON-TYNE.

CATTLE.

*Galloway Bulls.*

WILLIAM ROPER, Ling Side, Sebergham, Cumberland: FIRST PRIZE, 20*l.*, for "Rough Robin," black, 4 years 3 months 3 days-old; bred by exhibitor; sire, "Border Laddie;" dam, "Bonny Jeane;" sire of dam, "Rough Robin."

WILLIAM and JAMES SHENNAN, Bailig, Kirkcudbright: SECOND PRIZE, 10*l.*, for "Bob Burns," black, 9 years 3 months-old; bred by exhibitors; sire, "Geordie;" dam, "Martha;" sire of dam, "Galloway Jock."

ALEXANDER JARDINE, Applegirth, Lockerbie, N.B.: the *Reserved Number*, to "Hector," black, 3 years 5 months 1 week-old; bred by Mr. Cunningham, Tarbreoch, Castle Douglas, Kirkcudbright; sire, "Stanley;" dam, "Nancy."

*Award of Live-Stock Prizes at Newcastle-upon-Tyne.* lxiii

- SIR FREDERICK U. GRAHAM, BART., Netherby, Longtown, Cumberland : FIRST PRIZE, for "Eskdale," black, 1 year 5 months 3 weeks 4 days-old ; bred by Mr. Cunningham, Whitecairn, Castle Douglas, Galloway.
- JOHN CUNNINGHAM, Whitecairn, Dalbeattie, Kirkcudbrightshire : SECOND PRIZE, 10*l.*, for his black, 1 year 4 months 3 weeks-old ; bred by John Wallace, Longburns, Kirkcudbright.
- JAMES GRAHAM, Meikle Culloch, Dalbeattie : the *Reserved Number*, to "Glenorchy," black, 1 year 3 months 4 weeks-old ; bred by William and James Shennan, Bailig, Kirkcudbright ; sire, "Bob Burns" (235) ; dam, "Halliday."

*Galloway Cows and Heifers.*

- JAMES GRAHAM, Meikle Culloch, Dalbeattie : FIRST PRIZE, 15*l.*, for "Semiramis" (703), black, 6 years 2 months 4 days-old, in-milk and in-calf ; bred by exhibitor ; sire, "Guardsman ;" dam, "Hannah" (214) ; sire of dam, "Brother to Mosstrooper."
- JOHN CUNNINGHAM, Whitecairn, Dalbeattie : SECOND PRIZE, 5*l.*, for "Kate," black, 8 years 3 weeks-old, in-milk and in-calf ; bred by exhibitor ; sire, "Bruce ;" dam, "Beauty ;" sire of dam, "Wellington."
- JOHN CUNNINGHAM : the *Reserved Number*, to "Harriet," black, 5 years 4 months 2 weeks 3 days-old, in-milk and in-calf ; bred by exhibitor ; sire, "Kirkie ;" dam, "Kate ;" sire of dam, "Bruce."
- JAMES GRAHAM : FIRST PRIZE, 10*l.*, for "Rose of Galloway," black, 2 years 4 months 2 weeks 3 days-old, in-calf ; bred by exhibitor ; sire, "Sir James ;" dam, "Semiramis" (703) ; sire of dam, "Guardsman."
- JAMES GRAHAM : FIRST PRIZE, 10*l.*, for "2nd Harriet," black, 1 year 5 months 2 weeks 1 day-old ; bred by exhibitor ; sire, "Clansman ;" dam, "Semiramis" (703) ; sire of dam, "Guardsman."
- JAMES CUNNINGHAM, Tarbreoch, Dalbeattie : SECOND PRIZE, 5*l.*, for "Diana," black, 1 year 5 months 1 week 6 days-old ; bred by exhibitor ; sire, "Nelson ;" dam, "Jenny ;" sire of dam, "Kirkie."
- JAMES CUNNINGHAM : the *Reserved Number*, to "Juno," 1 year 4 months 2 weeks-old ; bred by exhibitor ; sire, "Nelson ;" dam, "Nancy ;" sire of dam, "Bruce."

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HORSES.

*Hunters.*

- SIR FREDERICK U. GRAHAM, BART., Netherby, Longtown, Cumberland : FIRST PRIZE, 20*l.*, "The Tyke," chesnut, 5 years-old (gelding) ; bred by Mr. Trotter (address unknown) ; sire of dam, "Sir Harry Dimsdale."
- JOHN B. BOOTH, Killerby, Catterick, Yorkshire : SECOND PRIZE, 5*l.*, for "Beechwood," bay, 6 years-old (gelding) ; bred by Smart Atkinson, Beaumont Hill, Darlington ; sire, "Lancewood ;" sire of dam, "Lord Collingwood."
- THOMAS SUTTON, Allwent Hall, Darlington : *Reserved Number*, to "Voyageur," dark chesnut, 6 years-old (gelding) ; bred by Mr. Reynolds, Navan, Meath ; sire, "Jolly Tar ;" sire of dam, "Spencer."
- WILLIAM HARDISTY CLARK, Hook, Howden, Yorkshire : FIRST PRIZE, 20*l.*, for "Sprig of Nobility," bay, 4 years-old (gelding) ; bred by Crowther Harrison, Melton, Hull ; sire, "Sprig of Shillelagh ;" dam, "Marigold ;" sire of dam, "Young Comas."

## **lxiv    *Award of Live-Stock Prizes at Newcastle-upon-Tyne.***

ROBERT NORMAN AND SON, High Close, Aspatria, Cumberland : SECOND PRIZE, 5*l.*, for "Radical," chesnut, 4 years-old (gelding); bred by exhibitors; sire, "A British Yeoman;" dam, "Chessie."

JOSEPH WHITWELL PEASE, Woodlands, Darlington : the *Reserved Number*, to "Silas Marnar," chesnut, 4 years-old (gelding); bred by H. A. W. Cocks, Low Middleton Hall, Darlington; sire, "Greatheart;" dam, "Miss Julia;" sire of dam, "Luck's All."

JAMES B. BOYD, of Doddington, Wooler, Northumberland : PRIZE, 10*l.*, for his chesnut 3 years-old (gelding); bred by exhibitor; sire, "Auchenleck," dam, "Kate;" sire of dam, "The Little Known."

RICHARD WELLINGTON HODGSON, North Dene, Gateshead, Durham : the *Reserved Number*, to his bay 3 years-old (filly); bred by exhibitor; sire, "Neville;" sire of dam, "Cheviot."

### *Roadster Stallions.*

THOMAS BROWN, Butterwick, Barton-le-Street, Malton, Yorkshire : PRIZE, 15*l.*, for "President Junior," bay, 9 years-old; bred by Mr. Newburn, Ingleby, Stokley, Yorkshire; sire, "Bay President;" sire of dam, "Lottery."

### *Roadster Mares or Geldings.*

RICHARD FORSTER, White House, Gateshead : PRIZE, 10*l.*, for "Multum-in-parvo," brown, 7 year-old (gelding); bred by James Fogerty, Ballinahoge, New Ross, County Wexford; sire, "Clowe;" sire of dam, "Redwing."

### *Ponies.*

REV. JOHN ALEXANDER BLACKETT ORD, Whitfield Hall, Haydon Bridge, Northumberland : PRIZE, 5*l.*, for "Little Stag," roan, 8 years-old (gelding); breeder unknown.

THOMAS RAMSAY, Sherburn Green, Gateshead : PRIZE, 10*l.*, for his white, aged (mare), in-foal; breeder unknown.

### *Pairs of Agricultural Mares or Geldings, or Mare and Gelding.*

CHARLES MARK PALMER, Whitley Park, Newcastle-on-Tyne : PRIZE, 10*l.*, for "Dick," grey, 7 years-old (gelding); breeder unknown; "Sharper," bay, 7 years-old (gelding); breeder unknown.

THE DUKE OF HAMILTON AND BRANDON, Hamilton Palace, Hamilton, Lanarkshire, N.B. : the *Reserved Number*, to "Sally," bay, 4 years-old (mare); bred by Christie, Buchlynie, Stirling, N.B.; sire, "Blackleg;" "Maggie," bay, 6 years-old (mare); bred by William Park, Balquhanran, Dalmuir, Dumbartonshire; sire, "Sir Colin Campbell;" dam, "Jess."

### *Agricultural Geldings or Fillies.*

THE DUKE OF HAMILTON AND BRANDON : FIRST PRIZE, 10*l.*, for "Darling," dark bay, 3 years-old (filly); bred by W. KNOX, Foreside, Crofthead, Renfrewshire; sire, "Samson;" dam, "Bess."

JOHN MUIR, Lochfergus, Kirkcudbright : SECOND PRIZE, 5*l.*, for "Brisk," bay, 3 years-old (filly); bred by Mr. White, Highdykes, Dumbarton, N.B.

JOHN LAWS, Kearsley, Matfen, Northumberland : PRIZE 5*l.*, for his bay, 2 years-old (gelding); bred by exhibitor; sire, "Farmer's Glory;" dam, "Bet;" sire of dam, "Young Doddington."



JOSEPH LAYCOCK, Gosforth, Newcastle-upon-Tyne: FIRST PRIZE, 10*l.*, for his bay 1 year-old (filly); bred by exhibitor; sire, "George 2nd;" dam, "Gip."

JONATHAN MELVIN PATTISON, Norwood, Gateshead: SECOND PRIZE, 5*l.*, for his bay 1 year-old (filly); bred by exhibitor; sire, "England's Glory;" dam, "Jolly;" sire of dam, "Wallace."

JOSEPH WHITWELL PEASE, Woodlands, Darlington: the *Reserved Number*, to "Effie," dark bay, 1 year-old (filly); bred by exhibitor; sire, "England's Glory;" dam, "Jewel;" sire of dam, "Lofty."

## SHEEP.

### *Border Leicester Rams.*

GEORGE SIMSON, Courthill, in Berwickshire; Kelso, Roxburghshire: FIRST PRIZE, 15*l.*, for his 1 year 3 months 2 weeks-old; bred by exhibitor.

THOMAS SIMSON, Blainslie, Lauder, Roxburgh: SECOND PRIZE, 5*l.*, for his 1 year 4 months-old; bred by exhibitor.

GEORGE SIMSON, Courthill, in Berwickshire; Kelso: the *Reserved Number*, to his 1 year 3 months 2 weeks-old; bred by exhibitor.

THOMAS SIMSON, Blainslie, Lauder, Roxburghshire: FIRST PRIZE, 15*l.*, for his 3 years 4 months-old.

JOSEPH WILSON and JOHN ANGUS, Whitefield, Morpeth, Northumberland: SECOND PRIZE, 5*l.*, for "Cockburn 2nd," 3 years 3 months-old; bred by John Angus, of Whitefield, Morpeth, Northumberland; sire, "Cockburn 1st."

JOHN ANGUS, Whitefield, Morpeth: the *Reserved Number*, to "Cockburn 3rd," 2 years 3 months-old; bred by exhibitor; sire, "Cockburn 1st;" sire of dam, "Hawkhill."

### *Border Leicester Ewes—Pens of Five.*

GEORGE SIMSON, Courthill, in Berwickshire; Kelso: FIRST PRIZE, 10*l.*, for his 1 year 3 months 2 days-old; bred by exhibitor.

JOHN ANGUS, Whitefield, Morpeth: SECOND PRIZE, 5*l.*, for his 1 year 3 months-old; bred by exhibitor; sire, "Cockburn 2nd."

THE HON. COL. EDWARD G. D. PENNANT, M.P., Penrhyn Castle, Bangor, Carnarvonshire: the *Reserved Number*, to his 1 year 3 months-old; bred by exhibitor.

WILLIAM PURVEY, of Lintow, Burnfoot, Kelso: FIRST PRIZE, 10*l.*, for his 2 years 3 months 2 weeks 3 days-old; bred by exhibitor; sire, "Hawkhill and Bob."

JOHN ANGUS, Whitefield, Morpeth: SECOND PRIZE, 5*l.*, for his 2 years 3 months-old; bred by exhibitor; sire, "Cockburn 1st."

### *Herdwick Rams.*

GEORGE BROWNE, Troutbeck, Windermere, Westmoreland: FIRST PRIZE, 15*l.*, for his 1 year 2 months 2 weeks-old; bred by exhibitor.

RICHARD BROWNE, Lowwood, Troutbeck, Windermere: SECOND PRIZE, 5*l.*, for "Moorcock," 1 year 2 months 1 week-old; bred by exhibitor.

lxvi *Prizes for Live-Stock and Wool at Newcastle-upon-Tyne.*

EDWARD NELSON, Gatesgarth, Buttermere, Cockermouth, Cumberland: the *Reserved Number*, to "Second Fiddle," 1 year 1 month 2 weeks-old; bred by exhibitor; sire, "Young Napoleon;" sire of dam, "General."

EDWARD NELSON: FIRST PRIZE, 15*l.*, for "Thousand-a-Year," 4 years 2 months-old; bred by exhibitor; sire, "General;" sire of dam, "Wasdale Champion."

GEORGE BROWNE, Troutbeck, Windermere: SECOND PRIZE, 5*l.*, for "No. 1," 7 years 2 months 2 weeks-old; bred by William Ritson, Wastel Head, Whitehaven, Cumberland.

DANIEL CROSTHWAITE, Hallgarth, Keswick, Cumberland: the *Reserved Number*, to his 4 years 2 months 2 weeks 6 days-old; bred by Isaac Hawall, Longscale, Keswick, Cumberland.

*Herdwick Ewes—Pens of Five,*

GEORGE BROWNE, Troutbeck, Windermere: FIRST PRIZE, 10*l.*, for his 1 year 2 months 2 weeks-old; bred by exhibitor.

EDWARD NELSON, Gatesgarth, Buttermere, Cockermouth: SECOND PRIZE, 5*l.*, for "Springflower," "Mayflower," "Queen," "Boss," "Dadden," 1 year 1 month 1 week-old; bred by exhibitor; sires, "Old Napoleon," "Young Napoleon," "Bloody Douglas," "Ned;" sires of dams, "General," "Joe," "Prince Talleyrand."

GEORGE IRVING, Wythrop Hall, Cockermouth: the *Reserved Number*, to his 1 year 2 months 2 weeks-old; bred by exhibitor.

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WOOL.

*Leicester—Five Fleeces.*

JOHN ANGUS, Whitefield, Morpeth, Northumberland: PRIZE, 2*l.*: shorn 2nd week in May, 1864, from sheep 15 months-old.

*Oxford Down—Five Fleeces.*

CHARLES HOWARD, Biddenham, Bedford: PRIZE, 2*l.*: shorn in May, from shearlings.

*Shropshire—Five Fleeces.*

AMEROSE ROBOTHAM, The Oak Farm, Drayton Bassett, Tamworth, Staffordshire: PRIZE, 2*l.*: shorn 17th May, from sheep 15 months-old.

*Hampshire—Five Fleeces.*

WILLIAM HUMFREY, Oak Ash, Wantage, Berkshire: PRIZE, 2*l.*: shorn 8th June, from sheep 16 months-old.

*Cheriot—Five Fleeces.*

CHARLES REA, Doddington, Wooler, Northumberland: PRIZE, 2*l.*: shorn in June, from sheep 15 months-old.

*Blackfaced—Five Fleeces.*

ALEXANDER WEARING LONG, Mint Cottage, Kendal, Westmoreland: PRIZE, 2*l.*: shorn in July, from sheep 2 to 3 years-old.

*Herdwick—Five Fleeces.*

EDWARD NELSON, Gatesgarth, Buttermere, Cockermouth, Cumberland: PRIZE  
2*l*. : shorn 6th July, from sheep 2 and 2 years-old.

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**BUTTER.**

*Firkin.*

JAMES NICHOLSON, Blencairn Hall, Penrith, Cumberland: PRIZE, 5*l*.

*Fresh.*

GEORGE MANDER ALLENDER, Lee Grange, Winslow, Buckinghamshire:  
PRIZE, 5*l*.

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**IMPLEMENTS.**

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**STEAM CULTIVATION.**

JOHN FOWLER and Co., 28, Cornhill, London, and Leeds: the PRIZE of ONE HUNDRED POUNDS, for their Set of Steam Cultivating Machinery without Implements; manufactured by the exhibitors. Comprising two 7-horse single-cylinder self-moving engines and windlasses combined, 800 yards best steel rope, 20 rope porters, and necessary tools. The engines to be worked in combination, so that the power of both engines is applied to the implement simultaneously.

JOHN FOWLER and Co.: the PRIZE of FIFTY POUNDS, for their Set of Steam Ploughing Machinery without Implements; manufactured by the exhibitors. Comprising a 14-horse power engine (self-moving) and windlass combined, an anchor, 20 rope porters, 800 yards best steel rope, headland ropes, and necessary tools.

JOHN FOWLER and Co.: the PRIZE of FIFTY POUNDS, for their Set of Steam Cultivating Machinery without Implements; manufactured by the exhibitors. Comprising one 7-horse power single-cylinder self-moving engine and windlass combined, anchor, 800 yards steel rope, 18 rope porters, and necessary tools.

JAMES and FREDERICK HOWARD, Britannia Works, Bedford: the PRIZE of TWENTY-FIVE POUNDS, for their Steam Cultivating Apparatus; invented and manufactured by the exhibitors. Ordinary 10-horse portable engine, with separate windlass, ropes, &c. The engine and windlass are stationed at one corner, or outside the field to be cultivated. Every variety of soil, and fields of any shape, can be worked.

JOHN FOWLER and Co.: the PRIZE of TWENTY POUNDS, for their Four-furrow Balance Plough and Digger, with Slack Gear; manufactured by the exhibitors.

J. and F. HOWARD: the PRIZE of TEN POUNDS, for their Four-furrow Steam Plough; invented and manufactured by the exhibitors. Constructed with 2 sets of bodies, right and left-handed, set point to point, and mounted upon strong flanged wrought beams. Scarifying and digging breasts can be substituted for the ordinary ploughing breasts.

lxviii *Award of Prizes for Implements at Newcastle-upon-Tyne.*

JOHN FOWLER and Co. : the PRIZE of SEVENTEEN POUNDS TEN SHILLINGS, for their Five-tined Balance Digger and Cultivator with Slack Gear ; manufactured by the exhibitors.

J. and F. HOWARD : the PRIZE of TWELVE POUNDS TEN SHILLINGS, for their Steam Cultivator and Ridging Plough Combined ; invented and manufactured by the exhibitors. The same implement as Howards' well-known Steam Cultivator, but furnished with a ridging-body and subsoiler. Intended to ridge and subsoil the land at one operation.

WILLIAM STEEVENS, Godolphin Road, New Road, Hammersmith, Middlesex : a SILVER MEDAL, for his Four-furrow Steam Plough and Cultivator Combined ; invented and improved by the exhibitor, and manufactured by J. Woodbourne, Kingsley. Is so well arranged that it can be made available for all general purposes of steam cultivation.

R. and H. COLEMAN and MORTON, London Road Works, Chelmsford, Essex : a SILVER MEDAL, for their Steam Cultivating Apparatus ; invented by Yarrow and Hilditch, London, and improved and manufactured by exhibitors. Consisting of a 10-horse power double-cylinder traction-engine, with windlass, steel wire rope, 2 cultivators, anchors, porters, and field tools complete. With this apparatus alone direct action is secured with the use of one engine.

J. and F. HOWARD : the PRIZE of TWENTY POUNDS, for their Steam Harrows ; invented and manufactured by the exhibitors. Is similar in principle to the exhibitors' zigzag-harrows for horse-power, but fitted with steerage, and adapted for steam-power.

JOHN FOWLER and Co. : the PRIZE of FIFTEEN POUNDS, for the best Windlass for Steam Power.

J. and F. HOWARD : the PRIZE of TEN POUNDS, for the second-best Windlass for Steam Power.

W. SAVORY and SONS, High Orchard Works, Gloucester : the PRIZE of FIVE POUNDS, for the third-best Windlass for Steam Power.

JOHN FOWLER and Co. : the PRIZE of TWENTY POUNDS, for the best Anchor for Steam Power.

AVELING and PORTER, Rochester, Kent : the PRIZE of TEN POUNDS, for their Rope Porter for Steam Power.

COLEMAN and MORTON : the PRIZE of FIVE POUNDS, for their Rope Porter.

RICHARD GARRETT and SON, Leiston Works, Saxmundham, Suffolk : HIGHLY COMMENDED, for their pair of Twelve-horse Power Winding Traction Engines ; invented by Savory and Son, Gloucester ; improved and manufactured by the exhibitors. For steam-cultivation.

J. and F. HOWARD : HIGHLY COMMENDED for their Two-furrow Steam Plough ; invented and manufactured by the exhibitors. Intended for extra deep tillage.

JOHN FOWLER and Co. : HIGHLY COMMENDED for their Rope Porters.

J. and F. HOWARD : COMMENDED for their Norwegian Steam Harrow ; invented and manufactured by the exhibitors. The same in principle as the well-known Norwegian Harrow, but fitted with steerage, and adapted for steam-power. Where a fine tilth is required, this is most effective.

J. and F. HOWARD : COMMENDED for their Rope Porters.



Ploughs.

**JAMES and FREDERICK HOWARD**: the PRIZE of FIFTEEN POUNDS, for their Plough (marked B B); invented and manufactured by the exhibitors. Intended for general purposes and deep work.

**RANSOMES and SIMS**, Ipswich, Suffolk: the PRIZE of SEVEN POUNDS TEN SHILLINGS, for their Iron Beam Plough (marked R N E), fitted with Two Wheels; invented, improved, and manufactured by the exhibitors. Has an improved solid beam trussed at its base, by which simplicity and strength are both attained. The wheels are new in design, their wearing surfaces are hardened, and dirt excluded, whilst the protruding axle is superseded. Fitted to produce square-cut work.

**RANSOMES and SIMS**: the PRIZE of SEVEN POUNDS TEN SHILLINGS, for their Iron Beam Plough (marked R N G), with Two Wheels; invented, improved, and manufactured by the exhibitors. For deep work. Capable of ploughing 10 to 12 inches deep on any soil. Strong enough for 4 or 6 horses.

**RANSOMES and SIMS**: the PRIZE of FIFTEEN POUNDS, for their Iron Beam Plough (marked R N F), Swing; invented, improved, and manufactured by the exhibitors. For square-cut work.

**RANSOMES and SIMS**: the PRIZE of SEVEN POUNDS TEN SHILLINGS, for their Iron Beam Plough (marked R N E), Swing; invented, improved, and manufactured by the exhibitors. Has a short beam, and is fitted for swing-ploughing, suitable for light land. It will produce square-cut work.

**McGREGOR and HUMPHREY**, Spring Garden Works, Aberdeen: the PRIZE of SEVEN POUNDS TEN SHILLINGS, for their Heavy Land or Deep Furrow Swing Plough; invented, improved, and manufactured by the exhibitors. Without wheels; the share is of wrought-iron.

**HUNT and PICKERING**, Goulding Works, Aberdeen, the PRIZE of TEN POUNDS, for their Turf and Stubble-paring Plough; invented, improved, and manufactured by the exhibitors. Adapted for paring any thickness from 1 to 3 inches, cutting double the width of the ordinary plough, leaving the work done in an advantageous state for the action of the atmosphere; all the cutting parts and shield-boards are made of cast-steel.

**E. H. BENTALL**, Heybridge, Maldon, Essex: the PRIZE of TEN POUNDS for his Patent Subsoil Plough (marked B I B F); invented, improved, and manufactured by the exhibitor.

**J. and F. HANCOCK**, Dudley Port, Tipton, Staffordshire: a SILVER MEDAL, for their Subsoil Pulverizer Plough; invented and manufactured by the exhibitors. Will act as a plough and subsoiler, or subsoiler only, for 3 to 12 inches deep.

**J. and F. HOWARD**: HIGHLY COMMENDED for their Plough (marked B); invented and manufactured by the exhibitors. Medium size of new set that have been brought out with the utmost care, and after careful and protracted experiments; the object sought being to combine the advantages of high-cutting ploughs, which lay the furrows at an acute angle, with those of the rectangular or low-cutting ones.

**RANSOMES and SIMS**: HIGHLY COMMENDED for their Iron Beam Plough (marked R N F), fitted with Two Wheels; invented, improved, and manufactured by the exhibitors. The mould-board and share are the result of many and careful experiments, and will be found to do first-rate work.

lxx *Award of Prizes for Implements at Newcastle-upon-Tyne.*

- F. and J. HOWARD : HIGHLY COMMENDED for their Plough (marked B B); invented and manufactured by the exhibitors. Intended for very deep ploughing or trenching.
- F. and J. HOWARD : HIGHLY COMMENDED for their Swing Plough (marked B B); invented and manufactured by the exhibitors. Without wheels, and with long handles and short beam. As the point of the share can be raised or lowered as it becomes worn, they have great advantage over the ordinary swing.
- RANSOME and SIMS : HIGHLY COMMENDED for their Cotgreave's Subsoil Fen Land and Trench Plough; invented by Mr. Cotgreave, Chester; improved and manufactured by the exhibitors. Combines the common trench and subsoil plough in one implement, and will till and pulverize the soil at one operation from 6 to 18 inches.
- WILLIAM BUSBY, Newton-le-Willows, Bedale, Yorkshire : HIGHLY COMMENDED for his Two-wheeled Plough, for General Purposes; invented, improved, and manufactured by the exhibitor.
- SEAMAN, LARKWORTHY, and Co., Lowesmoor Works, Worcester : HIGHLY COMMENDED for their Excelsior Iron Plough with Two Wheels and Drag Chain (N X 2); invented by Joseph Seaman, Worcester, and manufactured by the exhibitors. Suitable for general purposes, both on light and heavy land; easy in draught for 2 horses, but has sufficient strength for 4; with steel breasts.
- WILLIAM BALL and SON, Rothwell, Kettering, Northamptonshire : HIGHLY COMMENDED for their Heavy Land Plough; invented, improved, and manufactured by the exhibitors.
- JOHN GEORGE HARRISON, Ravensworth, Richmond, Yorkshire : HIGHLY COMMENDED for his Scotch Double Mould-board or Ridging Plough; improved by the Rev. William F. Wharton, Barnington Rectory, and manufactured by the exhibitor. By this plough land can be ridged and three times split for the same horse-power and depth that it can be once ploughed by the ordinary plough. The land is thoroughly broken up.
- WILLIAM BALL and SON : COMMENDED for their Iron Plough for Light Lands (B C X); invented, improved, and manufactured by the exhibitors.
- HUNT and PICKERING : COMMENDED for their Light Land Iron Plough (G W O); invented, improved, and manufactured by the exhibitors. Its improvements effect the following objects:—Rigidity maintained under the greatest strain, and without additional weight; better balancing in work, thus insuring increased solidity, uniformity, and steadiness, with considerably less exertion to holder.
- W. BALL and SON : COMMENDED for their Iron Plough for General Purposes (B C X); invented, improved, and manufactured by the exhibitors.
- MCGREGOR and HUMPHREY : COMMENDED for their Heavy-land or Deep Furrow Wheel-Plough; invented, improved, and manufactured by the exhibitors. Strong and powerful for deep and heavy work with 3, 4, or more horses.
- MCGREGOR and HUMPHREY : COMMENDED for their General Purpose Swing-Plough; invented, improved, and manufactured by the exhibitors. With wrought-iron share.
- RANSOMES and SIMS : COMMENDED for their Beauclerk's Archimedean Subsoil-Plough; invented by Lord Beauclerk; improved and manufactured by the exhibitors. Will pulverize the soil in the operation of subsoiling, at a depth of 6 to 12 inches below the ordinary ploughing.

*Award of Prizes for Implements at Newcastle-upon-Tyne.* lxxi

RANSOMES and SIMS: COMMENDED for their Strong 2-Horse Solid Beam Iron Plough (marked V R), fitted with Two Wheels; invented, improved, and manufactured by exhibitors. Adapted for any description of soil. Will turn a furrow 9 inches by 13½ inches.

CULTIVATORS, CLOD-CRUSHERS, ROLLERS, AND HARROWS.

E. H. BENTALL: the PRIZE of TWELVE POUNDS, for his Patent Light Broad-share, Cultivator, and Subsoil-Plough (marked L I B B); invented improved, and manufactured by the exhibitor.

COLEMAN and MORTON: the PRIZE of TEN POUNDS, for their Cultivator with Five Tines; invented by R. Coleman, Chelmsford; improved and manufactured by the exhibitors.

CHARLES, CLAY, the Stennard Works, Wakefield, Yorkshire: the PRIZE of EIGHT POUNDS, for his Patent Cultivator and Eradicator; invented, improved, and manufactured by the exhibitor. Is now in general use, and is applicable for all cultivating purposes. Fitted with side levers, seven tines and shares. The tines are raised out of the soil backwards, similar to a horse-rake, so as readily to relieve the implement when turning at the ends; width of cut 5 feet, and may be worked with 3 or 4 horses at a moderate depth.

THE BEVERLEY IRON AND WAGGON COMPANY: Beverley Iron Works, Beverley, Yorkshire; the PRIZE of NINE POUNDS, for their Patent Serrated Clod-Crusher and Roller, with Self-cleaning Action; improved and manufactured by the exhibitors. Each alternate disc is 3 inches larger in diameter than the rest, which enables it to work on moist soil without clogging.

WILLIAM CROSSKILL and SONS, Iron Works, Beverley: the PRIZE of SIX POUNDS, for their Improved Clod-Crusher; invented, improved, and manufactured by the exhibitors: 30 inches diameter, 6 feet wide.

W. C. CAMBRIDGE, Bristol: the PRIZE of FIVE POUNDS, for his Six-feet-and-a-half Double-Action Press-Wheel Roller and Clod-Crusher, Wheels 26 inches diameter; invented, improved, and manufactured by the exhibitor. Fitted with tubular iron shafts and frame, and has grease boxes on the checks.

AMIES and BARFORD, Queen Street Works, Peterborough, Northamptonshire: the PRIZE of SEVEN POUNDS, for their Wrought-iron Water Ballasting Land-Roller; invented, improved and manufactured by the exhibitors. Made with two separate water-tight cylinders of best wrought-iron plates, which can be loaded with water at pleasure. The extra weight is then employed upon the surface of the land with the greatest possible percentage of crushing power, and two rollers (light and heavy) secured in one instrument.

THE BEVERLEY IRON AND WAGGON COMPANY: the PRIZE of THREE POUNDS, for their Warwick Prize Plain Field Roller; improved and manufactured by the exhibitors. Consists of nine cast-iron cylinders, each 2 feet 8 inches in diameter, and 8 inches wide, placed on a round axle, with arms having grease boxes and loose journals.

J. and F. HOWARD: the PRIZE of EIGHT POUNDS, for their 3-Beam Zigzag Harrows (No. 10); invented and manufactured by the exhibitors. Recommended as a heavy set of harrows, within the power of a pair of horses.

J. and F. HOWARD: the PRIZE of SEVEN POUNDS, for their Drag-Harrows (No. 17); invented and manufactured by the exhibitors. Width, 9½ feet.

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J. and F. HOWARD: the PRIZE of FIVE POUNDS, for their Jointed Zigzag-Harrows (No. 15); invented and manufactured by the exhibitor. Width,  $8\frac{1}{2}$  feet.

COLEMAN and MORTON: HIGHLY COMMENDED for their Cultivator with Seven Tines (No. 9); invented by R. Coleman, Chelmsford, and improved and manufactured by the exhibitors.

AMIES and BARFORD: HIGHLY COMMENDED for their Press-Wheel Clod-Crusher and Land-Roller; invented, improved, and manufactured by the exhibitors. Made with a new solid wrought-iron frame and steerage guide-rod, by which the draught is diminished one-third; also fitted with patent self-regulating scrapers and seat for the driver. Size, 26 inches diameter by 6 feet long.

AMIES and BARFORD: HIGHLY COMMENDED for their Wrought-iron unbreakable Land-Roller; invented, improved, and manufactured by the exhibitors. The cylinders (in two parts) and the framing are made entirely of best wrought-iron, whereby the greatest strength with lightness is secured. The shafts are moveable, so that one or two horses can work abreast, as desired. Size, 7 feet long by 24 inches diameter; weight, about 7 cwt.

RANSOMES and SIMS: HIGHLY COMMENDED for their Set of Four-Jointed Harrows (No. 620); invented, improved, and manufactured by the exhibitors.

J. and F. HOWARD: HIGHLY COMMENDED for their Flexible or Chain-Harrow (F 2); invented and manufactured by the exhibitors. Made to cover 8 feet.

W. C. CAMBRIDGE: HIGHLY COMMENDED for his Seven-and-a-half feet Combined Tine and Chain-Harrow,  $7\frac{1}{2}$  feet long; invented, improved, and manufactured by the exhibitor. Combines all the essentials of the ordinary chain and the tine-harrow; for two horses.

S. CORBETT and SON, Park Street Works, Wellington, Salop: COMMENDED for their Cultivator, with Ten Tines; invented and manufactured by the exhibitors. Fitted with lever, &c., and adapted for broad-sharing stubbles, grubbing, and cultivating.

HUNT and PICKERING: COMMENDED for their Strong Wrought Field-Roller; invented, improved, and manufactured by the exhibitors. Fitted with three cylinders 24 inches diameter, 7 feet long, and so arranged as to remove the friction from the axle, excepting in the self-lubricating hard metal patent bushes; the axle-ends are case-hardened bushes easily renewed.

HILL and SMITH, Brierley Hill Iron Works, Staffordshire: COMMENDED for their Premium Wrought-iron Light Land-Roller (No. 1); invented and manufactured by the exhibitors.  $7\frac{1}{2}$  feet wide by 2 feet diameter. Can be drawn easily by one horse, and is light enough for barley-rolling.

BRICK AND TILE-MACHINES.

JOHN WHITEHEAD, Preston, Lancashire: the PRIZE of FIVE POUNDS, for his No. 1 Drain-Pipe, Brick, and Tile-Machine; invented, improved, and manufactured by the exhibitor.

JOHN WHITEHEAD: the PRIZE of TEN POUNDS, for his Vertical solid Brick-making-Machine: invented, improved, and manufactured by the exhibitor. Adapted only for solid bricks. A most suitable machine for exportation, as it may be worked by horse-power, steam, or water.



J. D. PINFOLD, Warwickshire Works, Rugby : the PRIZE of FIVE POUNDS, for his Drain-pipe and Brick-making Machine ; invented by Wright and Green and the exhibitor, and improved and manufactured by the exhibitor. Is self-acting and continuous ; simple, strong, and durable ; makes very superior bricks and pipes, in quantities limited by the means of removal only, and at a cost of from 2s. to 2s. 9d. per 1000.

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MISCELLANEOUS.

A. B. CHILDS, 481, New Oxford Street, London, and RICHES and WATTS, Duke's Palace Iron Works, Norwich : a SILVER MEDAL, for their Excelsior Grain-Separator (No. 3 size) ; invented and improved by A. B. Childs, and manufactured by Riches and Watts. Combining the action of blast, riddles, and exhaust, with an entirely new and improved arrangement of the riddles, by which oats and other foreign substances are effectually separated without waste.

A. B. CHILDS, and RICHES and WATTS : a SILVER MEDAL, for their Portable Self-sharpening American Grist-Mill ; invented by Amory Felton, of Troy, U. S. A. ; improved and manufactured by Riches and Watts. Very superior for grinding all kinds of grain for feeding purposes. Warranted to grind faster and more efficiently than any metal mill out. Arranged on a high stand ; so as to grind into a sack.

BURGESS and KEY, 95, Newgate Street, London : a SILVER MEDAL, for their Set of Draining Tools ; invented, improved, and manufactured by Parkes and Co.

AMIES and BARFORD : HIGHLY-COMMENDED for their Steam-power Chaff-Cutter, with Blast Delivering Apparatus ; invented, improved, and manufactured by the exhibitors. The novelty in this machine consists in a newly patented fan or elevator attached to the machine, by which the cut chaff can be delivered in any direction from the machine, and to any height desired, without manual labour.

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**Essays and Reports.—PRIZES FOR 1865.**—All Prizes of the Royal Agricultural Society of England are open to general competition. Competitors will be expected to consider and discuss the heads enumerated.

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### **I. MIDDLE CLASS EDUCATION.**

FIFTY SOVEREIGNS will be given for the best Essay on Middle Class Education, having reference to the improvement of the education of those who depend upon the cultivation of the soil for their support.

### **II. AGRICULTURE OF LEICESTERSHIRE.**

FIFTY SOVEREIGNS will be given for the best Report on the Agriculture of Leicestershire.

The principal geological and physical features of the county should be described; the nature of the Soil and character of the Farming in its different districts or natural divisions; its Live Stock; Implements; recent changes of Farm Management; Improvements lately introduced and still required; remarkable or characteristic Farms; the condition and management of Pasture Land, any increase or decrease in its area, any improved means for its renovation or enrichment, any change in the uses to which it is applied, being especially noticed.

### **III. SHEEP STOCK.**

TWENTY-FIVE SOVEREIGNS will be given for the best Essay on the Increase of Sheep Stock on Strong as well as Light Land.

### **IV. SHORTHORNS.**

TWENTY-FIVE SOVEREIGNS will be given for a Short History of Rise and Progress of Shorthorns.

### **V. CHEESE AND BUTTER.**

TWENTY-FIVE SOVEREIGNS will be given for the best Essay on the Comparative Profit of making Cheese, Butter, or of grazing Stock on Pasture Land of various qualities.

**VI. WATER SUPPLY.**

TWENTY SOVEREIGNS will be given for the best Essay on the Improvement of the Water Supply in Rural Parishes for Agricultural and Domestic Purposes.

**VII. FARM BUILDINGS.**

TWENTY SOVEREIGNS will be given for the best Essay on the Comparative Cheapness and Advantages of Iron and Wood in the construction of Roofs for Farm Buildings.

**VIII. RECLAMATION AND MARLING OF LAND.**

TWENTY SOVEREIGNS will be given for the best Account of the Reclamation of Waste or Inferior Land by Marling or Dry Warping.

**IX. ANY OTHER AGRICULTURAL SUBJECT.**

TEN SOVEREIGNS will be given for an approved Essay on any other Agricultural Subject.

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*Reports or Essays competing for the Prizes must be sent to the Secretary of the Society, at 12, Hanover Square, London, on or before March 1, 1865. Contributors of Papers are requested to retain Copies of their Communications, as the Society cannot be responsible for their return.*

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RULES OF COMPETITION FOR PRIZE ESSAYS.

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1. All information contained in Prize Essays shall be founded on experience or observation, and not on simple reference to books or other sources. Competitors are requested to use foolscap or large letter paper, and not to write on both sides of the leaf.

2. Drawings, specimens, or models, drawn or constructed to a stated scale, shall accompany writings requiring them.

3. All competitors shall enclose their names and addresses in a sealed cover, on which only their motto, the subject of their Essay, and the number of that subject in the Prize List of the Society, shall be written.\*

4. The President or Chairman of the Council for the time being shall open the cover on which the motto designating the Essay to which the Prize has been awarded is written, and shall declare the name of the author.

5. The Chairman of the Journal Committee shall alone be empowered to open the motto-paper of any Essay not obtaining the Prize, that he may think likely to be useful for the Society's objects; with a view of consulting the writer confidentially as to his willingness to place such Essay at the disposal of the Journal Committee.

6. The copyright of all Essays gaining Prizes shall belong to the Society, who shall accordingly have the power to publish the whole or any part of such Essays; and the other Essays will be returned on the application of the writers; but the Society do not make themselves responsible for their loss.

7. The Society are not bound to award a prize unless they consider one of the Essays deserving of it.

8. In all reports of experiments the expenses shall be accurately detailed.

9. The imperial weights and measures only are those by which calculations are to be made.

10. No prize shall be given for any Essay which has been already in print.

11. Prizes may be taken in money or plate, at the option of the successful candidate.

12. All Essays must be addressed to the Secretary, at the house of the Society, on or before the 1st of March, 1864.

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\* Competitors are requested to write their motto on the enclosed paper on which their names are written, as well as on the outside of the envelope.



## Members' Privileges of Chemical Analysis.

THE Council have fixed the following rates of Charge for Analyses to be made by the Consulting Chemist for the *bonâ-fide* use of Members of the Society; who (to avoid all unnecessary correspondence) are particularly requested, when applying to him, to mention the kind of analysis they require, and to quote its number in the subjoined schedule. The charge for analysis, together with the carriage of the specimens, must be paid to him by members at the time of their application.

No. 1.—An opinion of the genuineness of Peruvian guano, bone-dust, or oil-cake (each sample) .. .. .	5s.
„ 2.—An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts, and ammonia .. .. .	10s.
„ 3.—An estimate of the value (relatively to the average of samples in the market) of sulphate and muriate of ammonia, and of the nitrates of potash and soda .. .. .	10s.
„ 4.—An analysis of superphosphate of lime for soluble phosphates only .. .. .	10s.
„ 5.—An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia .. .. .	£1.
„ 6.—An analysis (sufficient for the determination of its agricultural value) of any ordinary artificial manure .. .. .	£1.
„ 7.—Limestone:—the proportion of lime, 7s. 6d.; the proportion of magnesia, 10s.; the proportion of lime and magnesia .. .. .	15s.
„ 8.—Limestone or marls, including carbonate, phosphate, and sulphate of lime, and magnesia with sand and clay .. .. .	£1.
„ 9.—Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime .. .. .	£1.
„ 10.—Complete analysis of a soil .. .. .	£3.
„ 11.—An analysis of oil-cake, or other substance used for feeding purposes; showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre; as well as of starch, gum, and sugar, in the aggregate .. .. .	£1.
„ 12.—Analyses of any vegetable product .. .. .	£1.
„ 13.—Analyses of animal products, refuse substances used for manure, &c. .. .. .	from 10s. to 30s.
„ 14.—Determination of the “hardness” of a sample of water before and after boiling .. .. .	10s.
„ 15.—Analysis of water of land drainage, and of water used for irrigation .. .. .	£2.
„ 16.—Determination of nitric acid in a sample of water .. .. .	£1.

N.B.—*The above Scale of Charges is not applicable to the case of persons commercially engaged in the Manufacture or Sale of any Substance sent for Analysis.*

The Address of the Consulting Chemist of the Society is, Dr. AUGUSTUS VOELCKER, 101, Leadenhall Street, London, E.C., to which he requests that all letters and parcels (postage and carriage paid) should be directed.

## **Members' Veterinary Privileges.**

### **I.—SERIOUS OR EXTENSIVE DISEASES.**

No. 1. Any Member of the Society who may desire professional attendance and special advice in cases of serious or extensive disease among his cattle, sheep, or pigs, and will address a letter to the Secretary, will, by return of post, receive a reply stating whether it be considered necessary that Professor Simonds, the Society's Veterinary Inspector, should visit the place where the disease prevails.

No. 2. The remuneration of the Inspector will be 2*l.* 2*s.* each day as a professional fee, and 1*l.* 1*s.* each day for personal expenses; and he will also be allowed to charge the cost of travelling to and from the locality where his services may have been required. The fees will be paid by the Society, but the travelling expenses will be a charge against the applicant. This charge may, however, be reduced or remitted altogether at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

No. 3. The Inspector, on his return from visiting the diseased stock, will report to the Committee, in writing, the results of his observations and proceedings, which Report will be laid before the Council.

No. 4. When contingencies arise to prevent a personal discharge of the duties confided to the Inspector, he may, subject to the approval of the Committee, name some competent professional person to act in his stead, who shall receive the same rates of remuneration.

### **II.—ORDINARY OR OTHER CASES OF DISEASE.**

Members may obtain the attendance of the Veterinary Inspector on any case of disease by paying the cost of his visit, which will be at the following rate, viz., 2*l.* 2*s.* per diem, and travelling expenses.

### **III.—CONSULTATIONS WITHOUT VISIT.**

Personal consultation with Veterinary Inspector	..	..	5 <i>s.</i>
Consultation by letter	..	..	5 <i>s.</i>
Consultation necessitating the writing of three or more letters.			10 <i>s.</i>
Post-mortem examination, and report thereon	..	..	10 <i>s.</i>

A return of the number of applications during each half-year being required from the Veterinary Inspector.

### **IV.—ADMISSION OF DISEASED ANIMALS TO THE VETERINARY COLLEGE; INVESTIGATIONS, LECTURES, AND REPORTS.**

No. 1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the same terms as if they were Members of the College; viz., by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs "a small proportionate charge to be fixed by the Principal according to circumstances."

No. 2. The College has also undertaken to investigate such particular classes of disease, or special subjects connected with the application of the Veterinary art to cattle, sheep, and pigs, as may be directed by the Council.

No. 3. In addition to the increased number of lectures now given by Professor Simonds—the Lecturer on Cattle Pathology—to the pupils in the Royal Veterinary College, he will also deliver such lectures before the Members of the Society, at their house in Hanover Square, as the Council shall decide.

No. 4. The Royal Veterinary College will from time to time furnish to the Council a detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary.

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GOVERNORS AND MEMBERS

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

1864.

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# ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

## List of Governors.

† Life Governor's mark.

- † Acland, Sir Thomas Dyke, Bart.... Killerton Park, Collumpton  
 Akroyd, Henry.... Doddington Hall, Nantwich  
 † Alcock, Thomas, M.P.... Kingswood Warren, Epsom  
 † Aldam, William, jun.... Frickley Hall, Doncaster  
 Anglesey, Marquis of.... Beaudesert Park, Rugeley  
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 † Appold, John George.... 23, Wilson Street, Finsbury, E.C.  
 † Arkwright, J. Hungerford.... Hampton Court, Leominster
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 † Barker, John Raymond.... Fairford Park, Fairford, Gloucestershire  
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 † Bath, Marquis of.... Longleat, Warminster  
 Bedford, Duke of.... Woburn Abbey, Bedfordshire  
 † Belper, Lord.... St. Helens, Derby  
 † Berners, Lord.... Keythorp Hall, Leicester  
 Betts, Edward Ludd.... Preston Hall, Maidstone  
 Blount, William.... Orchhill, Gerrard's Cross, Bucks  
 Bosanquet, George Jacob.... Broxbournebury, Hoddesdon, Herts  
 † Bowes, John.... Streatham Castle, Staindrop, Durham  
 Bramston, Thomas William, M.P.... Skreens, Chelmsford  
 Bridges, Sir Brook William, Bart., M.P.... Godnestone Park, Wingham, Kent  
 Bridport, Lord.... Cricket Lodge, Chard, Somersetshire  
 Briscoe, John Ivatt, M.P.... Fox Hill, Chertsey, Surrey  
 Bristol, Marquis of.... 6, St. James's Square, S.W.  
 † Brown, James.... Rossington, Bawtry  
 Buccleuch, Duke of, K.G.... 37, Belgrave Square, S.W.  
 † Buller, Edward.... Dilhorne Castle, Cheadle, Staffordshire  
 Buxton, Sir Robert Jacob, Bart.... Shadwell Court, Thetford
- Cabbell, Benjamin Bond.... 1, Brick Court, Temple, E.C.  
 † Cambridge, H.R.H. Duke of, K.G.... Gloucester House, Piccadilly, W.  
 Camoys, Lord.... Stonor Park, Henley-on-Thames  
 Campden, Viscount.... Campden, Gloucestershire  
 Carnarvon, Earl of.... High Clere Castle, Newbury  
 Challoner, Colonel B.... Portnall Park, Virginia Water, Staines  
 Chichester, Earl of.... Stanmer Park, Lewes, Sussex  
 † Childers, John Walbanke.... Cantley Hall, Doncaster  
 † Cholmeley, Sir Montague J., Bart., M.P.... Easton Hall, Colstersworth, Linc.

†Clive, Rev. Archer... Whitfield, Hereford

†Copeland, Alderman, M.P.... The Poplars, Leyton, Essex, N.E.

Cotes, John... Woodcote, Newport, Shropshire

Courtauld, Samuel... Gosfield Hall, Halsted, Essex

†Craven, Earl of... Coombe Abbey, Coventry

Curteis, Major Edward Barrett... Leesam House, Rye

Darnley, Earl of... Cobham Hall, Gravesend

†Dartmouth, Earl of... Patshall Hall, Wolverhampton

De Grey and Ripon, Earl... Studley Royal, Ripon

De La Warr, Earl... Buckhurst Park, East Grinstead, Sussex

Denison, John Evelyn, M.P.... Ossington, Newark, Nottinghamshire

†Derby, Earl of, K.G.... Knowsley Hall, Prescott, Lancashire

Dering, Sir Edw. Cholmeley, Bart., M.P.... Surrenden-Dering, Pluckley, Kent

Devonshire, Duke of, K.G.... Holker Hall, Milnthorpe, Westmoreland

Dickinson, Francis Henry... King's Weston, Somerton, Somersetshire

Downshire, Marquis of... Easthampstead Park, Wokingham, Berks

†Dysart, Earl of... Buckminster Hall, Colstersworth, Lincolnshire

Egmont, Earl of... Cowdray Park, Petworth

Essex, Earl of... Cassiobury Park, Watford, Hertfordshire

†Etwall, Ralph... Andover

Evans, Thomas William, M.P.... Allestree Hall, Derby

†Eversley, Viscount... Heckfield Place, Winchfield, Hants

†Exeter, Marquis of, K.G.... Burghley House, Stamford, Lincolnshire

†Eyre, Charles... Welford, Newbury, Berkshire

Farquharson, John James... Langton, Blandford

Feilding, Viscount... Downing, Holywell

†Fellowes, Edward, M.P.... Ramsey Abbey, Huntingdon

Feversham, Lord... Duncombe Park, Helmsley, Yorkshire

†Fortescue, Earl... Castle Hill, South Molton, Devon

†Freeland, H. W.... Chichester

†Fuller, Francis... 21, Parliament Street, S.W.

Gibbs, Ben. Thomas Brandreth... 47, Half-moon Street, London, W.

†Grey, Earl... Howick House, Alnwick

Hale, Robert Blagden... Alderley Park, Wootton

†Hamilton-Nisbet, Right Hon. R. D. C.... Bloxholme Hall, Sleaford, Lincolnshire

Hamond, Anthony... Westacre Hall, Brandon

†Harcourt, George Simon... 71, St. George's Square, S.W.

Hartley, W. H. H.... Lye Grove, Cross Hands, Sodbury, Gloucestershire

Hayter, Right Hon. Sir Wm. G., Bt., M.P.... Stowberry Park, Wells, Somersetshire

†Heneage, George Fieschi, M.P.... Hainton Hall, Wragby

†Henniker, Lord... Thornham Hall, Eye, Suffolk

†Heywood, Thomas Percival... Claremont, Manchester

†Hill, Viscount... Hawkstone Park, Shrewsbury

†Hobbs, William Fisher... Boxted Lodge, Colchester

†Hoghton, Sir Henry de, Bart... Bold Hall, Warrington

†Holford, R. Stayner, M.P.... Weston Birt House, Tetbury, Gloucestershire

Holland, Edward, M.P.... Dumbleton Hall, Evesham, Worcestershire

Hood, Hon. Major-General A. Nelson... Cumberland Lodge, Windsor

†Halse, Col. Sir Edward, Bart....Breamore House, Fordingbridge, Hampshire  
†Hunt, Zachary D....Aylesbury

Johnstone, Sir John V. B., Bart., M.P....Hackness Hall, Scarborough

Kerrison, Sir Edward Clarence, Bart., M.P....140, Piccadilly, W.  
†Knight, Frederick Winn, M.P....Wolverley House, Kidderminster

†Leconfield, Lord...Petworth House, Sussex  
†Le Couteur, Colonel...Belle Vue, Jersey  
Legh, William John...Lyme Park, Disley, Stockport  
†Leicester, Earl of...Holkham Hall, Norfolk  
†Leigh, Lord...Stoneleigh Abbey, Warwickshire  
Lemon, Sir Charles, Bart....Carclew, Penrhyn, Cornwall  
†Long, Walter, M.P....Rood Ashton, Trowbridge, Wilts  
†Lonsdale, Earl of...Lowther Castle, Penrith  
Lovelace, Earl of...East Horsley, Ripley, Surrey

Marlborough, Duke of...Blenheim Park, Oxon  
†Marshall, William, M.P....Pattendale Hall, Penrith  
†Miles, Sir William, Bart., M.P....Leigh Court, Bristol, Somersetshire  
Mills, Thomas...Tolmers, Hertford  
Montefiore, J. M....Worth Park, Crawley  
†Morrison, Alfred...Fonthill House, Hindon, Wilts  
Murray, Charles Robert Scott...Danesfield, Marlow, Buckinghamshire

Naper, James Lennox William...Lough Crew, Old Castle, Ireland  
†Northwick, Lord...Athenæum Club, S.W.

Palmer, Robert...Holme Park, Reading, Berkshire  
Patten, Col. John Wilson, M.P....Bank Hall, Warrington, Lancashire  
Pennant, Hon. Col. Edw. Gordon Douglas, M.P....Penrhyn Castle, Bangor  
†Perkins, Algernon...Hanworth Park, Hounslow, W.  
†Popham, Francis Leyborne...Littlecott, Hungerford, Berks  
†Portman, Lord...Bryanston House, Blandford, Dorsetshire  
†Powis, Earl of...Powis Castle, Welshpool

†Radnor, Earl of...Coleshill House, Highworth, Wilts  
Rayleigh, Lord...Terling Place, Witham, Essex  
Ridley, Sir Matthew White, Bart., M.P....Blagdon, Cramlington, Northumberland  
Rigg, Jonathan...4, Chester Place, Hyde Park Square, W.  
Robartes, Thos. J. Agar, M.P....Lanhydrock House, Bodmin  
Rogerson, John...St. Alban's Villa, Highgate Rise, N.  
†Rutland, Duke of...Belvoir Castle, Grantham

Saint Germans, Earl of...Port Eliot, Devonport  
†Sanford, Edward Ayshford...Nynehead Court, Wellington, Somersetshire  
†Scholey, William Stephenson...Freemantle Lodge, Castle Hill, Reading  
†Shadwell, Lucas...Fairlight, Hastings  
Shelley, Sir John Villiers, Bart., M.P....Maresfield Park, Uckfield, Sussex  
Shrewsbury and Talbot, Earl of...Ingestre, Staffordshire  
†Smith, John Abel, M.P....37, Chester Square, S.W.  
†Sondes, Lord...Elmham Hall, Elmham, Norfolk

Sotheron-Estcourt, Rt. Hon. Thos. H, S. B. E., M.P....Bowden Park, Chippenham  
 †Southampton, Lord...Whittlebury Lodge, Towcester  
 Stafford, Lord...Cotessy Hall, Norwich  
 Stanhope, John Spencer...Cannon Hall, Barnsley, Yorkshire  
 †Stradbroke, Earl of...Henham Park, Wangford, Suffolk  
 †Sutton, John Manners...Kelham, Newark, Notts

†Tanqueray, John Samuel...Hendon, Middlesex  
 Taunton, Lord...Stowey, Somersetshire  
 †Thompson, H. S., M.P....Kirby Hall, York  
 †Thorold, Sir John Charles, Bart....Syston Park, Grantham  
 †Torrington, Viscount...Yokes Court, Mereworth, Kent  
 Towneley, Lieut.-Col. Charles...Towneley, Burnley, Blackburn  
 †Tunno, Edward Rose...Warnford Park, Bishop's Waltham  
 Tuxford, George Parker...246, Strand, W.C.

Wales, H.R.H. Prince of, K.G....Marlborough House, S.W.  
 Walsh, Sir John, Bart., M.P....Warfield Park, Bracknell, Berkshire  
 Walsingham, Lord...Merton Hall, Thetford, Norfolk  
 †Warner, Edward, M.P....Higham Hall, Woodford  
 †Warwick, Earl of...Warwick Castle, Warwick  
 Westminster, Marquis of, K.G....Motcombe House, Shaftesbury  
 †Whitbread, William Henry...Southhill House, Bedford  
 †Williams-Chancellor, Rev. Sir Erasmus, Bt....Llanywormwood Pk., Carmarthensh.  
 Wilmot, Edward Woollett...Buxton, Derbyshire  
 †Wilson, Fuller Maitland...Langham Hall, Bury St. Edmund's  
 †Wilson, Henry...Stowlangtoft Hall, Bury St. Edmund's  
 Wilshere, William...The Frythe, Welwyn  
 Wynn, Sir Watkin Williams, Bart., M.P....Wynnstay, Rhuabon, Denbighshire

Zetland, Earl of...Aske Hall, Richmond, Yorkshire

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## List of Members.

† Life Member's mark.

## A.

†Abbey, George...Silsworth Lodge, Daventry  
 Abbey, John...The Grange, Wellingborough  
 Abbot, Chas. H....Bower, Long Ashton, Bristol  
 Abbott, Evelyn...Lowdham, Nottingham  
 †Abbott, Stephen, jun....Castleacre, Swaffham  
 Abbott, Wm...Hill Farm, Gt. Wigborough, Colchester  
 Abell, James, Leopard Grange, Worcester  
 Abell, Martin, Worcester  
 Abercorn, Marquis of, K.G....Chesterfield Ho., W.  
 †Abergavenny, Earl of...Birling Manor, Maidstone  
 Abraham, Rev. T. E....Barton Place, Mildenhall  
 Abraham, Thomas...Dunster, Taunton  
 †Abrey, Thos. S. H....Witham, Essex  
 †Ackers, James...Prinknash Park, Painswick  
 Acland, Sir Pere. P. F. Palmer, Bart....Bridgewater  
 Acland, Thos. Dyke...Sprydoncote, Exeter  
 Acock Arthur, Cold Aston, Northleach  
 Ackroyd, William...Westbourne Lodge, Otley  
 †Acworth, N. B....The Hook, Northaw, Middlesex  
 †Adair, A..Heatherton Park, Wellington, Somerset  
 Adair, Sir R. Shafto, Bart....20A, St. James's Square  
 Adam, Alexander...Boulogne-sur-Mer  
 Adams, Capt. G. Curtis, R.N....Anstey Hall, Coventry  
 Adams, G. T....Hawkhurst, Kent  
 Adams, Thos...New House, Marden, Herefordshire  
 Adams, William, Blaydon on Tyne  
 Adcock, William...Farndish, Wellingborough  
 †Adderley, Rt. Hon. C. B., M.P..Hams Hall, Minworth  
 Adeane, Henry J., M.P...Babraham Pk., Cambridge  
 Adkins, George C....The Lightwoods, Birmingham  
 Adney, John...Rowton, Wellington, Salop  
 †Ahrens, E..New Schlagsdorf, Schwerin, Mecklenbg.  
 Airey, George...Sherbrooke, Linden, Malvern  
 Akers, Henry...Black Bourton, Faringdon  
 †Akroyd, Edward, M.P...Bank Field, Halifax  
 Alder, Frederick John...Hagworthingham, Spilsby  
 Alderman, Rev. F. C....Kintbury, Hungerford  
 Alderman, Robert...Farndish, Wellingborough  
 †Alderson, John...Thornby Villa, Wigton  
 Aldous, Robert...Burlingham, Norwich  
 Aldridge, Edward...Chippenhams Court, Slough  
 †Aldridge, Major John...17, Cadogan Place, S.W.  
 †Aldworth, W., jun....Frilford, Abingdon  
 Alexander, Caledon...30, Belgrave Square, S.W.  
 †Alexander, Edward...Leominster  
 †Alington, G. M....Swinhope House, Grimsby  
 Alison, John...Brightlands, Reigate  
 †Allcroft, J. D....Worcester

Allday, John...Griston, Watton, Norfolk  
 †Allen, B. Haigh...Longerofts Hall, Lichfield  
 Allen, Chas. W....The Moor, Kington, Herefords.  
 Allen, Henry...Oakfield, Hay, Herefordshire  
 Allen, John R...Lyngford House, Taunton  
 Allen, Major Ralph S....Bathampton, Bath  
 Allen, Rev. Dr...Shouldham Hall, Downham Market  
 Allen, N...The Vache, Chalfont St. Giles, Bucks  
 Allen, J. Roscoe...Oak House, Preston, Lancashire  
 Allen, Stephen H....Eastover, Andover  
 Allen, Thomas...Thurmaston, Leicester  
 Allen, Thomas...Upton Cottage, Macclesfield  
 Allen, W...Wallsend, Newcastle-on-Tyne  
 Allen, W. T...Little Stambidge Hall, Rochford, Essex  
 Allenby, George...Hallington, Louth, Lincolnshire  
 †Allfrey, H. W...Hemingford Ho., Stratford-on-Avon  
 †Allfrey, Robert...Wakefield Park, Reading  
 Allender, G. M...Manor Farm, Quainton, Winslow  
 Allerton, Alex. R...Colemans, Prittlewell, Essex  
 Allington, Rev. J...Little Barford, St. Neot's, Hunts  
 Allison, James...Undercliffe, Sunderland  
 Allison, Wm. H...Bilby, East Retford  
 Allison, Wm. Henry...Hepburn Hall, Gateshead  
 Allix, Charles...Willoughby Hall, Grantham  
 Allnutt, Henry...200, Fleet Street, E.C.  
 Allsopp, Henry...Foremark Hall, Burton-on-Trent  
 †Ambler, Henry...Watkinson Hall, Halifax  
 Ames, John...Cleavelands, Lyme, Dorset  
 Ames, Lionel...The Hyde, St. Alban's  
 †Amhurst, W. A. T...Didlington Park, Brandon.  
 Amos, Chas. E...5, Cedars Road, Clapham Common  
 †Anderson, Alexander...  
 Anderson, A...12, Marlborough Cres., Newc.-on-Tyne  
 Anderson, David...10, Kenilworth Square, Dublin  
 Anderson, James, jun...Hedley Hall, Gateshead  
 Anderson, John...Cottingham Wood, Morpeth  
 †Anderson, R...Grey Street, Newcastle-upon-Tyne  
 Anderson, Robert A...Cirencester  
 Anderson, William...Bent House, South Shields  
 Anderton, G. jun...Howden Dyke, Howden, Yorks  
 Anderton, J...Cleckheaton, Leeds  
 Andrewes, C. J...Kate's Grove Iron-Works, Reading  
 Andrews, Charles...Harewood, Ross  
 Andrews, Henry...Wishford, Salisbury  
 Andrews, J...Kinneresley, Severn Stoke, Worcester  
 Angas, Wm...Neswick, Driffield  
 Angus, George...The Grange, Wallsend  
 Angus, John...Whitefield, Morpeth  
 Angus, John, jun...Whitefield, Morpeth  
 Angus, John...90, Percy Street, Newcastle-on-Tyne

Ankers, Robert B....Huxley Green, Chester  
 †Annandale, P....Shotley Grove, Newcastle-on-Tyne  
 †Anson, Sir John, Bart....Avisford, Arundel  
 Anstey, Samuel...Monabbilly Farm, Par Station  
 Anstice, J....Madeley Wood, Wellington, Salop  
 †Anstruther, J. H. L....Hintlesham Hall, Ipswich  
 †Aplin, Henry...Combe St.Nicholas, Chard,Somerset  
 †Appach,Reginald...Maytham Hall, Rolvenden,Kent  
 Appleby, John...Abbey Mills, Morpeth  
 Appleby, W....Smallburn, Longhorsley, Northumb.  
 †Applewhaite, Edward...Pickenham Hall, Swaffham  
 Apps, John, jun....Goudhurst, Staplehurst  
 †Araujo, Captain F. J. da Silva...Rio de Janeiro  
 †Arbuthnot, John A....Cowarth, Chertsey, Surrey  
 Arbuthnot, W. U....Bridgen Place, Kent  
 †Arcedeckne, Andrew...Gleivering Hall, Suffolk  
 Archer, James...Combermere Abbey, Salop  
 Argent, John...Manor Farm, Egham  
 Arkcoll, Thomas...The Meads, Eastbourne  
 Arkell, H....Butlers' Ct., Boddington, Cheltenham  
 †Arkell, T....Pen Hill Farm, Swindon, Wilts  
 Arkell, Thomas...Boddington, Cheltenham  
 Arkle, Thomas...Shaftoe, Newcastle-upon-Tyne  
 Arkwright, Rev. J....Mark Hall, Harlow, Essex  
 Arkwright, Peter...Willersby, Matlock  
 Armitage, Arthur...Moraston, Ross, Herefordshire  
 Armstrong, C...Hawthorn Ter., Newcastle-upon-Tyne  
 Armstrong, G...Heddon-on-the-Wall, Northumb.  
 Armstrong, George...Thornton Heath, Surrey  
 Armstrong, H., M.D...Peckham Ho., Peckham, S.E.  
 Armstrong, John...Palterton, Chesterfield  
 Armstrong, J. A....Bays Leap, Wylam, Northum.  
 Armstrong, Pearson...Newcastle-on-Tyne  
 Armstrong, Robert...Over Tabley, Knutsford  
 Armstrong, Wm. Jones...Killylea, Co. Armagh  
 Armytage, Col. H....  
 Arnold, Matthew...Westmeon, Petersfield  
 Arnold, Rev. Richard A....Ellough, Beccles  
 Arnot, James...Woodcote, Carshalton, S.  
 Arnould, Alfred Henry...Whitcross, Wallingford  
 Arthur, Lieut.-Col. C....Misterton Hall, Lutterworth  
 Ashby, James...Pleystone, Capel, Dorking  
 Ashby, T. W....Rutland Terrace, Stamford  
 Ashcroft, James...Cow Lane, Wavertree, Liverpool  
 Ashcroft, Thomas...Walford, Eccleshall, Staffs.  
 Ashdown, S. H....Uppington, Wellington, Salop  
 Ashhurst, John H....Waterstock, Oxford  
 Ashlin, John...Firsby, Spilsby  
 Ashmore, John...Norton, Evesham  
 Ashton, G. F....Stormer Hill, Totlington, Bury  
 †Ashton, Henry...Woolton, Liverpool  
 †Ashton, T. Henry...  
 Ashwin, Henry...Guiting Power, Winchcombe  
 Ashwin, Manley C....Ryon Hill, Stratford-on-Avon  
 Ashwin, Richard...Aldington, Evesham  
 †Askew, Sir H., Bt....Pallinsburn Ho., Coldstream  
 †Askew, Watson...Pallinsburn, Coldstream  
 †Astbury, Wm. C....4, Munster Ter., Fulham, S.W.  
 Asten, William...Oddingley, Droitwich  
 Astley, F. D. R....Duckinfield, Ashton-under-Lyme  
 †Astley, F. L'Estrange...Melton Constable, Thetford  
 †Aston, Samuel...Bushwood Lodge, Warwick  
 †Atherton, Tho....Chapel House, Speke, Liverpool

†Athorpe, J. C....Dinnington Hall, Rotherham  
 Athreton, George T....Beech Cottage, Wrexham  
 Atkins, A. Edwin...Farnham Court, Slough, Bucks  
 Atkinson, Benj....Manston Lodge, Whitkirk, Leeds  
 Atkinson, E....Laurel Bank, Potternewton, Leeds  
 Atkinson, G. C....Wylam Hall, Northumberland  
 †Atkinson, James...Winderwath, Penrith  
 †Atkinson, J. H....Angerton, Morpeth  
 Atkinson, John...Charlton, Salisbury  
 Atkinson, John...Peepy, Stocksfield-on-Tyne  
 Atkinson, Thomas...Newcastle-on-Tyne  
 †Atkinson, W....Gt. Rapers, Bures St. Mary's  
 Atkinson, W. S....Barrowby Hall, Whitkirk, Leeds  
 Atkinson, William...Ashton Heyes, Chester  
 †Atkinson, W. James...Marlow, Buckinghamshire  
 Attenborough, J....Brampton Ash, Market Harbro  
 Attwater, J. Gay...Ablington, Amesbury  
 Austin, W. H....Norton Shiffnal  
 Aveland, Lord...Normanton Park, Stamford  
 Aveling, Thomas...Rochester  
 Avery, Thomas Charles...Gloucester  
 †Avery, Wm. Howard...Stockton Grange, Shiffnal  
 Awbery, F. D....St. Lawrence Wootton, Basingstoke  
 Ayles, Stephen...Hall Pl. Farm, Braishfield, Romsey  
 †Aylesford, Earl of...Packington Hall, Coventry.  
 †Aylmer, H....West Dereham, Stoke Ferry, Norfolk  
 †Aylmer, J. B....Fincham Hall, Downham, Norfolk  
 Aylmer, John H....Walworth Castle, Darlington  
 †Aylmer, R. B....Westacre Abbey, Swaffham  
 †Aynsley, J. Murray...Underdown, Ledbury  
 Ayton, J. F...Hindley, Stocksfield, Northumberland  
 Ayton, F....Hindley, Stocksfield, Northumberland  
 Ayton, George H....Hindley, Newcastle-on-Tyne  
 †Aytoun, R. S....Inchdairnie, Kirkcaldie, N.B.

## B.

†Babington, Chas. C., M.A...St. John's, Cambridge  
 †Back, John Alfred...Thorpe Hamlet, Norwich  
 Bacon, Rev. H....Baxterley Rectory, Atherstone  
 Bacon, James, Pluckley, Ashford, Kent  
 Bacon, Samuel, jun....Ratcliffe Culey, Atherstone  
 †Backhouse, Edmund...Polam Hill, Darlington  
 Badcock, Benjamin...Broad Street, Oxford  
 Badcock, Henry...Taunton  
 Badcock, P....4, Aldridge Rd. Villas, Westbourne Pk.  
 Badham, G. D....Bulmer, Sudbury  
 Badham, George...Beckford, Tewkesbury  
 Bagnall, Henry A....Winlaton, Blaydon-on-Tyne  
 †Bagot, Lord...Blithfield, Rugeley, Staffordshire  
 Bagster, Benjamin...Denmead, Horndean  
 Bailey, Henry...The Gerwyn, Wrexham  
 †Bailey, James...Nynehead, Wellington, Somerset  
 †Bailey, Wm....Hazling, Belford, Northumberland  
 †Baillie, Evan...St. Austin's, Torquay  
 †Baillie, Hamilton...Ash Hall, Cowbridge  
 Baillie, Wm. Hunter...4, Upper Harley Street, W.  
 Baily, Rev. H. G....The Vicarage, Swindon  
 Baily, J., sen....113, Mount St., Berkeley Square, W.  
 Baily, T. F....Hall Place, Leigh, Tunbridge  
 Bainbridge, E. M....Leazes Villa, Newcastle-on-Tyne  
 Bainbridge, Robt. S....Woodhorn Grange, Morpeth

Bainbrigge, W. H. . . . Woodseat, Ashbourne, Derbysh.  
 Baker, Anne. . . Grendon, Atherstone  
 Baker, Benjamin Heath . . . Acle, Norwich  
 Baker, Chas. Newcombe . . . Half-moon Passage, E.C.  
 †Baker, Sir E. Baker, Bart. . . . Ranston Ho., Blandford  
 Baker, Eliza Maria . . . Thorngrove, Worcester  
 Baker, George W. . . . Parknook, Quorndon, Derby  
 Baker, H. Orde Lloyd . . . Hardwicke Court, Gloucester  
 Baker, Hugh Massey . . . Kidnall, Malpas  
 Baker, James. . . . Drayton Bassett, Tamworth  
 Baker, John . . . Hockley, Rayleigh, Essex  
 †Baker, John. . .  
 †Baker, Lake J. . . . Hargrave, Kimbolton  
 Baker, Robert. . . . Garnston, East Retford  
 Baker, S. Camfield . . . Beaufort St., King's Rd., S.W.  
 †Baker, T. Barwick L. . . . Hardwick Court, Gloucester  
 Baker, Thomas. . . . Barton, Cambridge  
 Baker, William. . . . Purewell House, Christchurch  
 †Baker, William H. . . . Westington, Campden, Glouc.  
 Baldwin, B. F. . . . The Ox Leasowes, Tardebigg  
 †Baldwin, John. . . . Luddington, Stratford-on-Avon  
 Baldwin, Thomas . . . Glasnevin, Dublin  
 Baldwin, Wm. Hen. . . . Normanton Hall, Normanton  
 Balfour, D. . . . Balfour Castle, Kirkwall, N.B.  
 Ball, Capt. Thomas . . . 85, Stephen's Green, Dublin  
 Ballard, Philip . . . Leighton Court, Hereford  
 †Balmer, Thomas . . . Fochabers, N.B.  
 Balston, Thomas . . . Chart Sutton, Staplehurst  
 Bancks, James . . . Prebendal House, Thame  
 Bancroft, William . . . Clifton Campvill, Tamworth  
 †Bankes, John Scott . . . Soughton Hall, Northop  
 †Banks, John Jackson . . . Kendal  
 Banks, Wm. J. . . . West Cliff, Dover  
 †Bannerman, Alexander . . . South Cottage, Chorley  
 †Bannerman, Henry . . . Hunton Court, Maidstone  
 Bannister, J. S. . . . Weston, Pembrige, Herefordshire  
 Banwell, William . . . Little Marlow, Bucks  
 Barber, George . . . Titlington Mount, Alnwick  
 Barber, Miles . . . Barlborough, Chesterfield  
 Barber, S. W. . . . Hayton Castle, Bawtry  
 Barber, William . . . Elm Hill, Grimley, Worcester  
 †Barbour, George . . . Bolesworth Castle, Chester  
 †Barbour, R. . . . Bolesworth Castle, Chester  
 Farchard, F. . . . Horsted Place, Horsted, Uckfield  
 Barclay, John . . . Falmouth  
 †Barclay, G. R. . . . Keavil, Dunfermline, Fifeshire  
 Barford, William . . . Peterborough  
 Baring, Hon. and Rev. F. . . . Melchit Park, Salisbury  
 Baring, John . . . Oakwood, Chichester  
 Barker, C. D. . . . Newcastle-on-Tyne  
 Barker, C. S. . . . 12, Buckingham St., Adelphi, W.C.  
 †Barker, Edward . . . Ruddington, Notts  
 †Barker, G. I. Raymond. . . . 20, Royal Crescent, Bath  
 †Barker, H. B. Raymond. . . . University Cl., Suffolk St.  
 Barker, H. . . . Suffolk Fire Office, Bury St. Edmund's  
 Barker, J. H. . . . Rowsley, Bakewell, Derbyshire  
 Barker, Thomas, North Shields  
 Barker, Walter R. H. . . . Wantage  
 Barlow, F. . . . The Shrubbery, Hasketon, Woodbridge  
 Barlow, Rev. P. . . . Cockfield Rec., Staindrop, Darlington.  
 Barnard, Charles. . . . Norwich  
 Barnard, Fulke Toovey . . . Albion Chambers, Bristol  
 Barnardiston, Nathaniel C. . . . The Ryes, Sudbury

†Barneby, J. Habington . . . Brockhampton, Worcester  
 †Barneby, William . . . Clater Park, Bromyard  
 Barnes, C. . . . Chorley Wood House, Rickmansworth  
 Barnes, Ralph . . . Exeter  
 †Barnes, T. . . . The Quinta, Chirk, N. Wales  
 Barnes, Thomas . . . Westland, Moynalty, co. Meath  
 Barnes, Wilson . . . Toft, Bourne  
 †Barnett, Charles . . . Stratton Pk., Biggleswade, Beds  
 Barnett, Henry . . . Glympton Park, Woodstock  
 Barnett, J. . . . Remenham Hill, Henley-on-Thames  
 Barnett, R. . . . Meopham Court, Gravesend  
 Barnett, William E. . . . Newcastle-on-Tyne  
 Barrass, James . . . Cramlington, Northumberland  
 Barrass, M., sen. . . . Killingworth, Newcastle-on-Tyne  
 Barrass, M., jun. . . . Killingworth, Newcastle-on-Tyne  
 Barratt, John R. . . . Maiden Hill, Penrith  
 Barrett, Alfred . . . Reading  
 Barrett, G. A. . . . Kate's Grove Iron-Works, Reading  
 Barrett, John B. . . . Milton House, Steventon, Berks  
 Barrington, Visc. . . . Beckett House, Faringdon, Berks  
 Barroby, Miss Elizabeth . . . Dishforth, Thirsk  
 †Barrow, Chas. James . . . Southwell, Notts  
 †Barrow, John James . . . Normanton Hall, Southwell  
 †Barrow, Wm. . . . Bilbrooke House, Wolverhampton  
 Barrs, T. . . . Brompton Hall, Churchstoke, Salop  
 †Barstow, Charles D. . . . Garrow Hill, York  
 Barter, Rev. C. . . . Sarsden, Chipping Norton  
 Barter, George . . . Nunnington, Hereford  
 Bartholomew, W. . . . Waddington Heath, Lincoln  
 †Barthropp, N. G. . . . Hacheston, Wickham Market  
 †Barton, Charles . . . Holbrook House, Wincanton  
 †Barton, Charles . . . Fifiold, Lechlade  
 Barton, Charles . . . Colin Rogers, Gloucester  
 Barton, Gerard . . . Fundenhall, Wymondham  
 †Barton John . . . Westleigh Lodge, Leigh, Lancashire  
 †Barton, Rev. H. N. . . . St. Ervan Rectory, Padstow  
 Barton, Rev. Joseph . . . East Leigh, Havant  
 †Barton, J. H. . . . Stapleton Park, Pontefract  
 Barton, Richard . . . Caldry Manor, Birkenhead  
 †Barwell, Thomas . . . Leicester  
 Baskerville, H. . . . Crawshay Park, Reading, Berks  
 Bass, Michael T., M.P. . . . Burton-on-Trent  
 Bass, W. . . . Duckenfield Lodge, Ashton-under-Lyme  
 Bassett, Richard . . . Bonvilstone, Cardiff  
 Bastard, T. Horlock . . . Charlton Marshall, Blandford  
 †Batard, T. M. Bearda . . . Ramsden Crays, Billericay  
 Batchelor, T. B. . . . Maindee, Newport, Monmouthsh.  
 Bate, Edward . . . Kelsterton, Flintshire, N.W.  
 Bate, Richard Stokes . . . Badger, Shifnal  
 Bate, Samuel . . . Springfields, Newcastle-under-Lyme  
 †Bateman, Henry . . . Asthally, Witney  
 †Bates, George . . . Blaxhall Hall, Wickham Market  
 Bates, Thomas, jun. . . . Eaton Green, Luton, Beds  
 Bathurst, Earl . . . Cirencester, Gloucestershire  
 Bathurst, Hon. Wm. L. . . . 38, Half-moon Street, W.  
 Bathurst, Lt.-Col., M.P. . . . Clarendon Pk., Salisbury  
 †Batson, Thos. . . . Combe House, Bath  
 Batt, William Henry . . . West Drayton, Uxbridge  
 †Batcock, F. . . . Hemingford Abbots, St. Ives, Hunts  
 Batten, Abraham . . . Ayott St. Peter's, Welwyn  
 †Batten, John . . . Yeovil  
 Battle, John R. . . . Potter Hanworth, Lincoln  
 Baugham, Geo. A. . . . Bridgenorth, Salop



- †Baxendale, J.... Woodside, Whetstone, N.  
 Baxendale, Richard B.... Woodside, Whetstone, N.  
 Baxter, H. J.... Cheadle, Manchester  
 Baxter, Robert.... Doncaster  
 Baxter, Thomas.... Acton Grange, Warrington  
 †Bayden, Thomas.... Hythe, Kent  
 Bayes, Charles.... Kettering  
 Bayley, Daniel (Captain)... Tallaght, co. Dublin  
 Bayley, Thomas.... Lenton, Nottingham  
 Bayley, William.... Britwell Farm, Maidenhead  
 Bayne, William.... High Street, Oxford  
 Baynes, G.... South Prestyn Lodge, South Shields  
 Bayning, Rev. Lord.... Honingham Hall, Norfolk  
 Bayzand, Joseph.... Kingley Arrow, Alcester  
 Beach, John A.... The Hill, Staunton Swan, Worc.  
 Beach, Joseph.... Flour Mill, Dudley  
 †Beach, Sir M. E. H., Bt., M. P. Williamstrip Pk., Fairfield.  
 Beachell, John.... Rawcliffe, Selby, Yorkshire  
 Beadell, Wm. James.... Chelmsford  
 Beadon, Rev. F.... North Stoneham Rectory, Hants  
 Beale, E. T.... 237, High Holborn, W.C.  
 Beale, Jos.... Boro' Fields, Walton, Burton-on-Trent  
 †Beale, William.... Larkins Farm, Chiddington  
 Bealey, J. Edward.... Bloxwich, Walsall, Staffs.  
 Beamand, William.... Newcastle, Clun, Salop  
 †Bean, Alf. W.... Dansom Park, Welling, S.E.  
 †Bearcroft, E.... Mere Hall, Droitwich  
 Beard, John.... Linton, Burton-on-Trent  
 Beard, W.... Tormarton, Cross Hands, Chippenham  
 Beards, Thomas.... Stowe Park, Buckingham  
 Bearn, William.... Finedon Hill, Higham Ferrers  
 †Beart, Robert.... Godmanchester, Huntingdonshire  
 Beasley, John.... Brampton, Northampton  
 †Beattie, James.... Newbie House, Annan, N.B.  
 Beauchamp, Chas. D.... 93, Lansdowne Road, W.  
 Beauchamp, Sir T. W. B., Bt.... Langley Hl., Norwich  
 Beaumont, E. B.... Woodhall, Barnsley, Yorkshire  
 Beaumont, Francis H.... Buckland Court, Reigate  
 †Beaumont, Geo., jun.... Bridgeford Hill, Notts  
 †Beaumont, J. A.... Park House, Wimbledon, S.W.  
 Beaumont, Richard.... Settrington House, York  
 †Beaumont, W. B., M. P.... Bywell Hall, Newc.-on-Tyne  
 Beaven, Charles.... Clyffe Pypard, Wootton Bassett  
 Becher, Rev. John Drake.... Southwell  
 Beck, Charles W.... Upton Priory, Macclesfield  
 Beck, J.... St. Ann Street, Lynn, Norfolk  
 Beck, Peter.... Shrewsbury  
 Beck, W. A.... Esthwaite Lodge, Hawkshead, Lane.  
 Beckett, Richard Trim.... Oulton Farm, Tarporley  
 Beckett, Richard.... Watton Abbey, Driffield  
 Beckwith, Rev. H.... Eaton Constantine, Wellingtn., Sal.  
 †Beckwith, Thos. Percival.... 52, Eaton Place, S.W.  
 Beddard, J.... Holloway Ho., Prestwood, Stourbridge  
 Beddoe, Richard C.... 4, Whetstone Place, Clifton  
 Beecroft, William.... Upton, Chester  
 Beaver, Rev. William Holt.... Cowbridge  
 Beever, Henry.... Blyth, Workson  
 Beever, John, M. D.... Newark-on-Trent  
 Begbie, Alexander.... Lytham, Preston, Lancashire  
 †Begg, David, M. D.... Canons Park, Edgware, N.W.  
 Belcher, Charles.... Little Coxwell, Faringdon  
 †Beldam, Valentine.... Royston, Hertfordshire  
 †Bell, Daniel.... Hollins, Whitehaven  
 Bell, Capt. Henry.... Chalfont Lodge, Cheltenham  
 Bell, John.... Breaks Hall, Appleby, Westmoreland  
 Bell, Matthew.... Bourne Park, Canterbury  
 Bell, Matthew.... Woolsington, Newcastle-on-Tyne  
 Bell, Robert.... Newcastle-on-Tyne  
 Bell, Thos.... Marlborough Cres., Newcastle-on-Tyne  
 Bell, William.... Cramlington, Northumberland  
 Bell, William.... 4, Westgate, Newcastle-on-Tyne  
 Bell, William Read.... Gillingham, Bath  
 Bell, Williams R.... Gillingham, Bath  
 †Bence, Capt.... Kentwell Hall, Long Melford  
 Bence, Henry A.... Thorington Hall, Saxmundham  
 Benington, T.... Wallfing Ho., North Cave, Yorks.  
 †Bennell, Joseph.... Hitchin, Herts  
 †Bennett, B. E.... Marston Trussell Hall, Rugby  
 Bennett, E.... Bedstone Ho., Aston-on-Clun, Salop  
 Bennett, George.... 30, Fenchurch Street, E.C.  
 Bennett, Rev. Henry Thorpe.... Egham  
 Bennett, James.... Ingestone, Ross  
 Bennett, John.... Little Rissington, Burford, Oxon  
 Bennett, John Ewins.... Bosworth Grange, Rugby  
 Bennett, Jos. B. H.... Tubbury, Burton-on-Trent  
 Bennett, T.... Park Farm, Woburn, Bedfordshire  
 Bennett, Thos. Oatley.... Bruton, Somersetshire  
 Bennett, Wm.... Regent Street, Cambridge  
 Bennon, Ed. David.... Summer Hill, Oswestry  
 Benson, Alan.... Papcastle, Cockermonth  
 †Benson, George.... Lutwyche Hall, Wenlock, Salop  
 Benson, John.... Tavistock  
 †Benson, William.... Allerwash House, Hexham  
 Bentall, Edward H.... Heybridge, Maldon, Essex  
 Bentley, Henry.... Eshald House, Woodlesford, Leeds  
 Bentley, Robert John.... Firmingley Park, Bawtry  
 Bentley, Wm. Handy.... Sansome Place, Worcester  
 Benyon, Rev. E. R.... Culford Hall, Bury St. Edm.  
 †Benyon, R., M. P.... Englefield House, Reading  
 Berger, Wm. Thomas.... Saint Hill, East Grinstead  
 Beridge, Rev. Basil.... Algaickirk, Spalding  
 Berkeley, Cuthbert.... Marley Hill, Gateshead  
 †Berkeley, Robert.... Spetchley Park, Worcester  
 †Berners, John.... Holbrook, Ipswich  
 †Berners, Lady.... Keythorpe Hall, Leicester  
 †Berney, Sir Hanson, Bart.... Sheepy, Atherstone  
 †Berrington, A. D.... Pant y Goitre, Newport, Mon.  
 Besley, Henry.... South Street, Exeter  
 Bessborough, Earl of.... Pilltown, Ireland  
 †Best, Hon. and Rev. S.... Abbotts Ann, Andover  
 Best, Jas., jun.... The Hill Top, Tenbury  
 Best, Rev. Thomas.... Red Rice House, Andover  
 Bethell, William.... Rise, Beverley  
 Bettinson, R.... Cawthorpe, Bourne, Lincolnshire  
 Betts, John.... King's Langley, Hertfordshire  
 Bevan, Beckford.... Bury St. Edmund's  
 Beverley, Matthew B.... Leeds  
 Reviss, John.... Sydling, Dorchester, Dorset  
 Bickford, Joseph.... Oxley, Wolverhampton  
 Biddell, G. Arthur.... Ipswich  
 †Biddell, Herman.... Playford, Ipswich  
 †Biddell, Manfred.... Playford, Ipswich  
 †Biddell, W.... Hawstead Hall, Bury St. Edmund's  
 Biddulph, Col. R. M., M. P.... Chirk Castle, Chirk, N.W.  
 Bidwell, Charles.... Muriels, Ely  
 Biehl, John.... Crowhurst, Battle



Biel, W.... St. Leonard's Farm, Beaulieu, Southpton.  
 Bigg, E. Smith... The Hyde, Slaugham, Sussex  
 Bigg, T... Leicester House, Great Dover Street, S.E.  
 Bigge, Chas. Selby... Bourton Grange, Much Wenlock  
 Biggs, John... Cublington, Leighton Buzzard  
 Bill, John... Trent Vale, Stoke-on-Trent  
 Billington, Leonard... Bull Hotel, Preston, Lancashire  
 Bingham, Col. R.H... Bingham's Melcombe, Dorchester  
 †Birch, George Francis... Clare Park, Farnham  
 Birch, Thomas... Grafton Farm, Hereford  
 Birch, Wyrley... Wretham Park, Thetford  
 †Birchall, T... Kibbleson Hall, Preston, Lancashire  
 †Bircham, William G... Duntun, Fakenham  
 Bird, Geo... Chessington Court, Kingston, S.W.  
 †Bird, J... Yaxley, Stilton, Huntingdonshire  
 Bird, Josiah... Shouldham Abbey, Downham Market  
 †Bird, Rev. J. Waller... Briston, East Dereham  
 †Birkbeck, Henry... Norwich  
 †Birkbeck, Robert... Gatton, Reigate  
 Birket, C... Plungington Hall, Preston, Lancashire  
 Birkin, Richard... Apsley Hall, Nottingham  
 Birmingham, Wm... Killerton, Broadcliff, Devon  
 Birt, Jacob... 30, Sussex Gardens, Hyde Park, W.  
 Biscoe, T.P.B... Kingellie House, Newton, Inverness  
 Bishop, James... Stretton Hall, Penkridge  
 Bishop, John... 3, The Walk, Market Pl., Norwich  
 Bitton, E.C... Newcastle-on-Tyne  
 Black, Edward... High Street, Boston  
 Black, James...  
 Blackburn, D... Temple Brewer, Sleaford, Linc.  
 Blackburne, Jas. Taddy... 17, Parliament St., S.W.  
 Blackburne, J. Ireland... Hale, Warrington  
 Blackburne, Lt.-Col. L., jun... Hale Hall, Warrington  
 Blackden, J.C... Heatherslaw House, Coldstream  
 †Blacker, M.C... Claremont, Claremorris, Mayo  
 Blackett, Sir E., Bart... Matfen, Newcastle-on-Tyne  
 Blackett, E.A., R.N... Oakwood, Wylam, Northum.  
 Blackstone, J... 1, Gloucester Rd., Regent's Pk., N.W.  
 Blagrove, Col. John... Calcot Park, Reading  
 †Blair, John...  
 Blair Thomas... Mitford, Morpeth  
 Blake, Alfred... Sutton, Stanton-Harcourt, Witney  
 Blake, Francis John... Norwich  
 Blake, William... Bridge, South Petherton  
 Blake, Wm. John... Danesbury, Welwyn  
 Bland, George... Coleby Hall, Lincoln  
 Bland, William... Hartlip, Sittingbourne  
 Blandford, Thomas... Corbridge, Northumberland  
 Blane, Col. Robt... The Oaks, Sunninghill, Staines  
 Blanshard, H.E... Jesmond Dene Hall, Newcastle  
 †Blanshard, Richard... 53, Chancery Lane, W.C.  
 Blashill, Henry... Steps Farm, Downhill, Hereford  
 †Blathwayt, George Wm... Dyham, Chippenham  
 Blencowe, J. George, M.P... Bineham, Lewes  
 †Blencowe, Robert A... 21, Gt. George St., S.W.  
 Blencowe, Robert Willis... The Hooke, Lewes  
 Blenkinsop, John... Simonside Ho., South Shields  
 Blenkinsop, Samuel... Lobley Hill, Gateshead  
 Blenkiron, William... Middle Park, Eltham  
 Blick, John... Hill Court, Droitwich  
 Blinkhorn, Thomas... Spalding  
 †Blisset, Rev. H... Letton, Weobley, Hereford  
 Blomfield, John... Warham, Wells, Norfolk

Bloomer, G. B... The Farm, Lower Stonnali, Walsall  
 Bloxside, Samuel... Warwick  
 Blundell, J... Bursleden, Southampton  
 Blundell, John... Crook Hall, Chorley  
 Blundell, W. H... 27, Snow Hill, Birmingham  
 Blurton, W. Mountfort... Field Hall, Uttoxeter  
 Blyth, D'Urban... Great Massingham, Rougham  
 Blyth, H.E... Sussex Farm, Burnham, Lynn  
 †Blyth, James... 24, Hyde Park Gardens, W.  
 †Board, John... Westerham, Sevenoaks  
 Boards, Edward... Edmonton, N.  
 Boards, William... Edmonton, N.  
 †Boby, Charles... Stutton, Ipswich  
 †Boby, Robert... Bury St. Edmund's  
 Bodenham, Charles... Hereford  
 †Body, R. B... Hyde End, Shinfield, Reading  
 Boger, Deeble... Woisdon, Devonport  
 †Boghurst, William P... Frating Abbey, Colchester  
 Bogue, John Morris... Westward Park, Wigton  
 Boileau, Sir J.P., Bt... Ketteringham Pk. Wymndhm.  
 Boiston, Thomas... Shipcote, Gateshead  
 Bolam, C.G... Bentinck Terr., Newcastle-on-Tyne  
 Bolam, Harry G... Keverstone, Staindrop, Durham  
 Bolam, W. T... Bentinck Terr., Newcastle-on-Tyne  
 Bolden, Samuel E... Springfield Hall, Lancaster  
 †Bolitho, Edward... Pendilverne, Penzance  
 †Bolitho, T. S... Pendilverne, Penzance  
 †Bolitho, William... Penzance  
 †Bolton, Lord... Bolton Hall, Bedale  
 Bolton, Daniel... Offington, Worthing  
 Bolton, G. Frost... 1, Pleasant Row, Newc.-on-Tyne  
 Bomford, Benjamin... Pitchill, Evesham  
 Bomford, Heming James... Dunnington, Alcester  
 Bond, Barnabas... Alburgh, Harleston, Norfolk  
 Bond, Benjamin... Draycot, Cheadle, Staffordshire  
 Bond, Frederick... Whitelackington, Ilminster  
 Bond, George... Earl Soham, Wickham Market  
 Bond, Rev. N... Creech Grange, Wareham  
 Bond, Robert... 10, Queen Street, Ipswich  
 Bone, Henry... Avon, Ringwood, Hants  
 Bonnell, J. H... Pelling Place, Old Windsor  
 †Bonner, H. C... East Rudham, Rougham, Norfolk  
 Bonner, W. Griffiths... Holme Lacy, Hereford  
 Bonus, Schröder... Point House, Blackheath, S.E.  
 †Booth, James Godfrey... Hamburg  
 Booth, John B... Killerby, Catterick, Yorkshire  
 Booth, John... Cotham, Newark, Nottinghamshire  
 Booth, Richard... Warlaby, Northallerton  
 Booth, S. Lister... Bramley, Leeds  
 Borman, Luke... Irby, Caistor, Lincolnshire  
 Booth, Sir William, Bt... Paxton Park, St. Neots  
 †Borough, C. B... Chetwynd Pk., Newport, Salop  
 Borries, Christian... Quay, Newcastle-on-Tyne  
 Borries, Theo... Greenside Ho., Blaydon-on-Tyne  
 Borston, Thomas... Shipcote, Gateshead  
 Borwick, John... Prospect, Carrickfergus  
 †Bortier, Monsieur... La Panne  
 Borton, John... Barton-le-Street, Malton  
 Bosanquet, Rev. R. W... Roch, Alnwick  
 Bosley, John... Lower Leyde, Hereford  
 Bostock, Ellis... 41, Hunter St., Brunswick Sq., W.C.  
 Bostock, Thomas... Hill Top, Burslem  
 Bosworth, J. Green... Greetham, Oakham, Rutland

- †Botham, George...Wexham Court, Slough, Bucks  
 Botly, Wm....Salisbury Villa, Upper Norwood, S.  
 Bott, William...Nantwich  
 Botteley, Thos. Downes...Black Lake, W. Bromwich  
 Botting, William...Westmeston Pl., Hurstpierpoint  
 Boucherett, Henry Robert...Hoarcross, Rugeley  
 †Bouck, John T....Manchester  
 Boulton, J....Noyadd Ho., Aberayron, South Wales  
 †Bourn, J....Mawley, Cleobury-Mortimer  
 Bourne, John...Hildenstone, Stone, Staffordshire  
 Bourne, John...N. E. Railway, Newcastle-on-Tyne  
 Bourne, Sam....Goldsmith Ho., Whitechurch, Salop  
 Bourne, Thomas...Newcastle-on-Tyne  
 Bourne, William...Atherstone  
 Bouverie, Philip Pleydell...Brymore, Bridgewater  
 Bowen, J., jun....Dunvall Ho., Bridgenorth, Salop  
 Bowen, P. W....Shrawardine Castle, Shrewsbury  
 †Bower, Edw. Greaves...Closworth, Sherborne, Dorset  
 Bower, Capt. Thomas B...Iwerne House, Blandford  
 Bower, George...St. Neots  
 Bowler, Wm. Anthony...9, Whitehall Place, S.W.  
 Bowley, William...Cirencester  
 Bowly, David...Cirencester  
 Bowly, Edward...Siddington House, Cirencester  
 Bowser, R....Bishop Auckland, Durham  
 †Bowstead, Thomas...Eden Hall, Penrith  
 †Bowyer, Capt. H. A....Steeple-Aston, Woodstock  
 Box, John...Civil Engineer  
 Boxall, W. B....Strathfieldsaye, Winchfield  
 Boyd, E. Fenwick...Moor House, Durham  
 Boyer, W....Pywell House, Northampton  
 Boys, John...Goldhanger, Maldon  
 Boys, Robert...Eastbourne  
 Braby, James...Maybanks, Rudgwick, Horsham  
 Bracebridge, C. H....Atherstone Hall, Atherstone  
 Bradburn, William...Hilton, Wolverhampton  
 Bradburne, J. Hanbury...Pipe Place, Lichfield  
 Bradbury, Thomas...Longroyd, Brighouse  
 Bradbury, Thomas Swanwick...Winsford, Cheshire  
 Bradbury, Wm....Bradley Green Colliery, Congleton  
 Braddock, Henry...Bury St. Edmund's  
 †Braddock, Thomas...Cathedral Steps, Manchester  
 Bradley, Thomas...Richmond, Yorkshire  
 †Bradshaw, John...Knowle, Guildford  
 Bradshaw, W....Slade Ho., Levenshulme, Manchester  
 Bradstock, Thomas S....Cobrey Park, Ross  
 Brady, Henry Bowman...Newcastle-on-Tyne  
 Braginton, George...Torrington, Devon  
 †Braikenridge, J. H....Chew Magna, Bristol  
 Bramley, Charles...Fiskerton Hall, Lincoln  
 Bramwell, C....Hardwicke Hall, Ferry Hill, Durham  
 Brand, Hon. Henry, M.P....Glynde, Lewes  
 †Brander, R. B....Tanbridge House, Horsham  
 Brandon, Benjamin...Ross, Herefordshire  
 Branson, William Chas....Little Weldon, Wansford  
 Branwhite, F....Chapel House, Long Melford, Suffolk  
 Brasnett, J....Hilboro' Lodge, Brandon, Norfolk  
 Bravender, John...Cirencester  
 Bray, George...The Haven, Dilwyn, Leominster  
 †Braybrooke, Lord...Audley End, Saffron Walden  
 †Breach, J. G....  
 Breavington, W. G. K....Bath Road, Hounslow, W.  
 Erebner, James...Norfolk Farm, Windsor Great Park  
 Brett, John...Burton Joyce, Nottingham  
 Brett, John...Oxton Grange, Southwell  
 Brett, John Lowdham...Corfe Lodge, Wimborne  
 Brett, Wilford George...The Lodge, Esher  
 †Bretts, Chas....  
 Brewster, Jas...2, Westbourne Road, Barnsbury, N.  
 Brewster, S. N....Beacon Hill House, Woodbridge  
 Brewster, W....Balderton Hall, Windillo, Shrews.  
 Brickwell, C. J....Overthorpe Lodge, Banbury  
 Bridge, Thomas...Wynford Eagle, Dorchester  
 Bridge, Thomas...Buttsbury, Ingatestone  
 Bridges, Joshua...London Road, Worcester  
 Briggs, John A....Eastgate House, Tenterden  
 Briggs, Rev. T. Barker W....Caple Lodge, Folkestone  
 Briggs, William...Hylton Castle, Sunderland  
 Bright, J....Longford, Market Drayton, Shropshire  
 †Bright, John...Teddlesley Park Farm, Penkridge  
 Bright, John, M.D....19, Manchester Square, W.  
 †Brisco, Sir Robert, Bt....Crofton Hall, Wigton  
 †Brise, Lieut.-Col. S.B.R....Finchingfield, Braintree  
 †Broadhurst, John...Foston, Derby  
 Broadmead, Philip...Milverton, Somerset  
 Brodhurst, Lucas, Manton, Worksoy  
 Brodie, John...Newcastle-on-Tyne  
 Brodie, John, jun....Newcastle-on-Tyne  
 Bromet, William R....Cocksford, Tadcaster  
 Bromfield, H....Hollow Meadow, Stratford-on-Avon  
 Bromley, James...Cockerham, Lancaster  
 Bromley, John...Derby  
 Bromley, John...Lancaster  
 Bromley, Robert...Derby  
 Bromwich, Thomas...Woolston, Coventry  
 Brook, Arthur Sawyer...Bexhill, Hastings  
 Brook, J....Park Farm, St. Helen's, Isle of Wight  
 Brooke, Edward...Marsden House, Stockport  
 Brooke, John W....Sibton Park, Yoxford, Suffolk  
 Brooke, John, jun....Capel, Ipswich  
 Brooke, Rev. John...Houghton, Shifnal  
 †Brooke, Sir R., Bart....Norton Priory, Runcorn  
 Brooke, T. J. Langford...Mere Hall, Knutsford  
 †Brooke, William...Northgate House, Huddersfield  
 †Brooke, Sir W. De Capell, Bart....Market-Harbro'  
 †Brooks, Bernard...Lyford, Abingdon  
 Brooks, J. Crosse...Carville, Newcastle-on-Tyne  
 Brook, James H....Henley-on-Thames  
 Brooks, J. M....7, Charlotte Street, Manchester  
 Brooks, Samuel...Bank, Manchester  
 Broomfield, Thomas...Lauder, N.B.  
 Broomfield, Thomas...Quay, Newcastle-on-Tyne  
 Broomhall, T. T....Beech Cliff, Newcastle, Staffords.  
 Brough, Charles...Blackett St., Newcastle-on-Tyne  
 †Broughton, Capt. J. P., jun...Tunstall Hall  
 Broughton, Capt. P....Cherry Mount, Kells, Ireland  
 Broughton, E. Delves...Wistaston Hall, Nantwich  
 Broughton, J....Almington Hall, Market Drayton  
 Brown, Edmund J. J....East Boldon, Gateshead  
 Brown, B....Manor House, Shipbourne, Tunbridge  
 Brown, Cuthbert...2, Derwent-pl., Newc.-on-Tyne  
 Brown, David...Cathendine House, Brecon  
 Brown, David...North Earle, Wooler, Alnwick  
 †Brown, Douglas...15, Hertford Street, Mayfair  
 Brown, Edw....4, Chesterfield St., Euston Rd., N.W.  
 Brown, George...Avebury, Chippenham

Brown G....Burdon Place, Jesmond, Newc.-on-Tyne  
 Brown, George...Roborough House, Barnstaple  
 Brown, George...Troutbeck, Windermere  
 †Brown, Rev. H. H....  
 Brown, Henry...Ashby-de-la-Zouch  
 Brown, James...26, Battery Place, Rothsay, N.B.  
 Brown, John...Tring  
 Brown, John...Coldham Hall, Wisbeach  
 Brown, John...Compton, Newbury  
 Brown, J. Washbourne...Ufcott, Swindon  
 Brown, Rev. Lancelot R....Kelsall, Saxmundham  
 Brown, Martin...Benton, Newcastle-on-Tyne  
 Brown, Michael L....Cliff Ville, Stoke-on-Trent  
 †Brown, Potto...Houghton, Huntingdon  
 Brown, Professor Geo. Thomas...Cirencester  
 Brown, Ralph...Whickham, Gateshead  
 Brown, Richard...Cippenham, Slough  
 Brown, Robert...Wigginton House, Tamworth  
 †Brown, Thomas...Buckham Hall, Uckfield  
 †Brown, Thomas...Marham, Downham Market  
 Brown, Thos. James...The Moor, Hereford  
 Brown, Thomas...Townsend, Horton, Devizes  
 Brown, William...Tring  
 Brown, William...Devizes (North Wilts Foundry)  
 †Brown, William...Richmond Hill, Liverpool  
 Brown, Wm....Wirsall, Whitechurch, Salop  
 Brown, W. J....Hazlebury House, Chippenham  
 Brown, Wm....Kenton Lodge, Kenton, Northumb.  
 †Browne, Lord John Thomas...Wesport, co. Mayo  
 Browne, Edward...Oaklands, St. Alban's  
 Browne, R. P....Gt. Hallingbury, Bishops Stortford  
 Browne, Robt. Palmer...Greenwich, S.E.  
 Browne, Rev. T. C....59, High Street, Oxford  
 Browne, Samuel...Brockton, Shifnal  
 Browne, Thos. Beale...Salperton Park, Andoversford  
 Browne, T. B....Mellington Hill, Churchstoke, Shrewsb.  
 †Browne, W....Monkton Farleigh Ho. Bradford, Wilts  
 Browne, William...Titchwell, Lynn  
 Browning, A. H....Chalvey Court, Slough  
 Browning, F....La Patrimoine, St. Lawrens, Jersey  
 Browning, James T....Oxford  
 Browning, S....Joint Counties Asylum, Abergavenny  
 †Brownlow, Earl...Ashridge, Berkhamstead  
 Bruce, Maj. C. L. C., M.P....Dunphail, Forres, N.B.  
 Bruce, John...Tiddington, Stratford-on-Avon  
 Brunson, Benjamin...Ross  
 Bryan, Frederick Thos....Humberstone, Leicester  
 Bryan, John...Southleigh, Witney  
 Brymer, John...1, Belvedere, Weymouth  
 †Bubb, Anthony...Witcombe Court, Gloucester  
 Buchanan, David...The Lodge, Clifton, Rugby  
 †Buck, Albert...Sansome Terrace, Worcester  
 †Buckingham, Duke of...Wootton, Aylesbury  
 Buckland, George...Benenden, Cranbrook, Kent  
 Buckland, J. Avery...Benenden, Cranbrook, Kent  
 Buckland, Thomas, jun....Wraysbury, Staines  
 Buckle, John...Uckington, Cheltenham  
 Buckley, Gen. E. P., M.P....New Hall, Salisbury  
 Buckley, Jas...Penyfae Ho., Llanelly, Caermarthens.  
 Buckley, John N....Normanton Hill, Loughborough  
 Buckman, Professor...Bradford Abbas, Sherborne  
 Buckworth, T. R....Cockley Cley Hall, Swaffham  
 †Budd, J. Palmer...Ystalyfera, Swansea

Budd, William...Aston-le-Walls, Daventry  
 †Budd, Thos. W....13, Norfolk Cres., Hyde Pk., W.  
 Buddicom, Wm. B....Penbedw Hall, Mold  
 Bugg, Walter...Milborne Wick, Sherborne  
 Buggins, W....Booth's Farm, New Oscott, Birming.  
 †Bulford, James...Hordley Farm, Woodstock  
 †Bulkeley, Sir R. W., Bt., M.P....Baron Hill, Beaumaris  
 Bull, Alban...Hanwell, Banbury  
 Bulled, Edmund...Wetheridge, Devonshire  
 Bullen, E....Irish Farmers' Cl., Sackville St., Dublin  
 †Bullen, John T....Marshwood Manor, Crewkerne  
 Buller, Sir A., Bart....Pound, Plymouth  
 Buller, James Wentworth, M.P....Downes, Crediton  
 †Buller, Morton Edward...Dilhorn, Cheadle  
 Bullerwell, George...Fellside, Gateshead  
 Bullimore, R....Stowgate Farm, Market Deeping  
 †Bullock, F....Woodlands Hall, Eling, Southampton  
 †Bullock, George...East Coker, Somerset  
 Bullock, Walter...Foulkbourne Hall, Witham  
 Bulmer, Charles...Holmer, Hereford  
 Bulmer, Charles...Saltwell, Gateshead  
 Bulmer, Jeff., jun....Middleton-on-Row, Darlington  
 †Bult, James S....Dodhill Ho., Kingston, Taunton  
 Bult, Samuel J....Great Abshot, Titchfield  
 Bulwer, Rev. James...Hanworth Rectory, Thetford  
 Bulwer, Wm. Lytton...Heydon Hall, Reepham  
 Bunbury, Henry M....Marlston House, Newbury  
 Bundock, Alex. F....22A, Connaught Square, W.  
 Bunning, J. W....Newcastle-on-Tyne  
 Bunny, Capt. Edward John...Slinfold, Horsham  
 †Bunsen, G....Bourg-Rheindorf, Bonn, Prussia  
 Burberry, J. J....Crofts, Alveston, Stratford-on-Avon  
 †Burdett, E....Manor Farm, Lyvedon, Thrapstone  
 Burden, R....Castle Eden, Stockton-on-Tees  
 Burdon, George...Heddon Ho., Newcastle-on-Tyne  
 Burgess, Capt. H. W....3, Lancaster Terrace, N.W.  
 Burgess, Robt....Winterbourne, Zeiston, Blandford  
 Burgess, William...93, Newgate Street, E.C.  
 Burgoyne, Sir J. M., Bt....Sutton Park, Pottton, Beds  
 Burkall, E. W....Winteringham, Barton-on-Humber  
 Burleigh, Robert W....Halesworth  
 Burn, Robert Scott...Stockport  
 Burn, William...Broomhill, Acklington  
 Burnard, Chas. F....Compton Villa, Plymouth  
 Burnell, Edward...Roydon, Diss  
 Burnell, E. P....Winkburne Hall, Southwell, Notts  
 Burness, W....2, South Place, Acre Lane, Brixton, S.  
 Burnett, David...Ashley, Stockbridge, Hants  
 †Burnett, Francis...Kingscote, Wotton-under-Edge  
 Burnett, G. H....High Hedgefield, Blaydon-on-Tyne  
 Burnett, Gregory...Dee Cottage, Flint  
 Burnett, Thomas...Hutton, Preston, Lancashire  
 †Burniston, Rich....Greenlands, Henley-on-Thames  
 Burnup, Cuthbert...Newcastle-on-Tyne  
 Burnup, J. M....Newcastle-on-Tyne  
 †Burr, Daniel Higford...23, Eaton Place, S.W.  
 Burrard, Sir George, Bt...Walhampton, Lymington  
 †Burrell, Charles...Thetford  
 Burrell, J....3, High Swinburne Pl., Newc.-on-Tyne  
 Burrell, Robert...Palace Green, Durham  
 Burroughes, H. N....Burlingham Hall, Norwich  
 Burroughes, Rev. J....Lingwood Lodge, Norwich  
 Burroughes, Rev. T....Gazeley, Newmarket



Burroughes, William...Colteshall Hall, Norwich  
 Burrows, Richard...Ruddington, Notts  
 Burrows, T. Ash...Normanton-on-Trent, Newark  
 Burt, Edwin...Charlton House, Wraxall, Bristol  
 Burt, Henry...6, St. Mark's Sq., Regent's Pk., N.W.  
 Burton, R. H. L...Chilton Grove, Shrewsbury  
 Burt, J. B...Kettering  
 Bury, Charles...Nazing, Essex  
 Busby, Henry Goodear...Moreton-in-the-Marsh  
 Bush, J. A...Grainger Villa, Newcastle-on-Tyne  
 †Bush, John W...  
 Bush, R. Hilhouse...Litfield Ho., Clifton, Bristol  
 †Bushby, Henry Jeffreys...40, Chester Square, S.W.  
 Bushell, William...Poulton, Wingham, Kent  
 Busk, E. Thos...Ford's Grove, Edmonton, N.  
 †Busk, Joseph...Codicote Lodge, Welwyn  
 Butcher, W...Bowling Green Farm, Ewell  
 †Butler, Hon. C. L...Coton House, Rugby  
 Butler, Capt. G. C...Stanford Place, Faringdon  
 Butler, Capt. J...Kirby Ho., Inkpen, Hungerford  
 Butler, Lieut.-Col...Liphook  
 †Butler, Paul...Down Ampney Ho., Cricklade, Wilts  
 †Butler, Wm...Badminton, Chippenham  
 Butt, Henry...Westmancote, Tewkesbury  
 Butt, T...Pirton Farm, Kempsey, Worcestershire  
 Button, William...Botley, Oxford  
 Buxton, W...Lime Tree Lodge, Rotherhithe, S.E.  
 Byrd, David...Milford, Stafford  
 Byrd, Sampson...The Leese Farm, Stafford  
 Bywater, R. F...Coniston, Ambleside

## C.

Cabrera, Gen. (Ct. de Morella)...Wentworth, Chertsey  
 Cadle, Clement...Ballingham Hall, Ross  
 Cadle, John...Much Birch, Ross  
 Cadle, Thomas...Longcroft, Westbury-on-Severn  
 Cadogan, Mrs...Brenkburn Priory, Morpeth  
 Cafferata, William...Newark, Nottingham  
 Caffin, Peter...Wörth, Sussex  
 Cail, Richard...Fell Cottage, Gateshead  
 Caines, James...Cheselborne, Dorchester, Dorset  
 Caird, Jas., M.P...Baldon, Newton Stewart, N.B.  
 †Calcraft, J. H., M.P...Kempstone, Corfe Castle  
 Caldecott, C. M...Holbrook Grange, Rugby  
 †Caldecott, Thos...Rugby Lodge, Rugby  
 Caldwell, Bonham...Leominster  
 Caldwell, H. B...Lackham House, Chippenham  
 Caldwell, John...Inworth, Kelvedon  
 †Caless, Wm...Bodicote House, Banbury  
 †Call, Sir W. B., Bart...Whitford Ho., Callington  
 †Calthorpe, Hon. F. H. W. G., M.P...Perry Hall, Staffs.  
 †Calverley, Chas. C...61, York Place, Edinburgh  
 Calverley, John...Oulton Hall, Leeds  
 †Calvert, Frederic...9, St. James's Place, S.W.  
 †Calvertt, J. S...Tothill Manor House, Alford, Linc.  
 Cambridge, W. C...Sydney Villa, Bedminster  
 Camden, Marquis, K.G...Wilderness Pk, Seven Oaks  
 Cammell, Chas...Norton Hall, Derbyshire  
 †Cameron, A. H. F...Lakefield, Glen Urquhart  
 Camp, James...Ilfracombe  
 Campaign, Joseph George...Cowbit, Spalding

Campaign, S., jun...Deeping St. Nicholas, Spalding  
 Campo, J. W. del...3, Knightsbridge, S.W.  
 Campbell, A...Auchindarroche, Lochgilphead  
 Campbell, Sir A. T. C., Bart...  
 Campbell, Charles Lee, Thurstaston Hall, Birkenhd.  
 Campbell, R...Buscot Park, Lechlade  
 Campion, Wm. J...Dannys, Hurstpierpoint  
 Camps, Henry...Salterley Grange, Cheltenham  
 Camps, Wm...40, Park St., Grosvenor Square, W.  
 Cane, Edward...Berwick, Lewes  
 Cane, Rev. T. C...Southwell  
 Cann, W. M...Dawlish, Devon  
 Canning, George H...Shottery, Stratford-on-Avon  
 Canning, Wm. Browne...Elston, Devizes  
 Cannon, Joseph Sims...Beckley, Oxford  
 Cantrell, Charles Seward...Riding Court, Datchet  
 Cantrell, H...Bayliss Court, Slough  
 †Capel, Arthur...Bulland Lodge, Wiveliscombe  
 Capel, Wm...The Grove, Stroud, Gloucestershire  
 Capper, R. Harecourt...N. Gate, St. Weonard's, Ross  
 †Carew, K. Russell...Carpenders Park, Watford  
 †Carew, Thomas...Collipriest House, Tiverton  
 †Carew, W. H. Pole...Antony House, Devonport  
 Cardus, T...Barwell Court, Kingston, Surrey, S.W.  
 †Cardwell, E. H...11, Cromwell Place, W.  
 Carey, Arthur...Oak Hall, Winstead, N.E.  
 Cargey, George...Osmaston Manor, Derby  
 Cargey, Gilbert...Kiplin, Catterick  
 Carius, George...Heaton, Newcastle-on-Tyne  
 †Carleton, Hon. and Rev. R...24, Grosvenor Place  
 †Carline, R...Lincoln  
 Carlin, Wm., jun...Marsh Cott., Keyingham, Hull  
 †Carnegie, David...Eastbury, Watford  
 Carnegie, Hon. J. J...Fair Oak, Petersfield  
 Carr, John...Roseworth, Newcastle  
 Carr, Rd. Storer...St. James St., Newcastle-on-Tyne  
 Carr, William...Stackhouse, Settle  
 Carr, W. R...Scotswood, Blaydon-on-Tyne  
 Carrick, William, jun...Tarn Lodge, Carlisle  
 †Carrington, T. S. Townsend...Eaton Dovedale, Derby  
 Carrington, William T...Hollington, Uttoxeter  
 Carroll, W. Hutchinson...Tulla House, Nenagh  
 Carter, G...Tyndales, Danbury, Chelmsford  
 †Carter, John Bonham, M.P...Adhurst St. Mary's  
 Carter, J. R...Lanark Villa, Torquay  
 Carter, M. F...Newnham, Gloucester  
 Carter, Richard H...Hullington, Chippenham  
 Carter, R. M...Leeds  
 Carter, William...Boughton Blean, Faversham  
 †Cartwright, Col. H., M.P...Kineton, Warwick  
 Cartwright, G. K...14, Upper Seymour St. West, W.  
 Cartwright, John...Craycombe House, Pershore  
 Cartwright, John...Shrewsbury  
 Cartwright, Nathaniel...Haugham, Louth  
 Cartwright, Richard Aubrey...Edgecott, Banbury  
 Cartwright, T. R. B...Aynhoe, Brackley, Northamp.  
 †Cartwright, T. W...Ragnall Hall, Newton, Newark  
 Cartwright, Col. W...Weedon  
 †Cartwright, Wm. George...Newport, Monmouths.  
 Cartwright, W. S...Stow Ho., Newport, Mon.  
 Carver, William...Ingarsby, Leicester  
 †Case, J. B...Poulton Hey, Bebbington, Birkenhead  
 Case, Thomas H...Testerton Hall, Fakenham



Castellain, Alfred... Liverpool  
 Castree, Josiah... College Green, Gloucester  
 Catchpool, Edward... Feering Bury, Kelvedon  
 Cater, J. W... West Lodge, Barnet, N.  
 †Cathcart, Earl... Thornton-le-Street, Thirsk  
 Cathcart, Sir John A., Bart...  
 †Cathcart, R... Pitcairnie Ho., Auchtermuchty, Fifes.  
 Cator, Maj.-Gen. (R.H.A.)... Arsenal, Woolwich, S.E.  
 †Cator, Rev. T... Wentbridge House, Pontefract  
 Cattley, Rev. Richard... Worcester  
 †Caulfield, J. Molyneux, Lt.-Col... Moy, co. Tyrone  
 †Caulfield, St. George... Donamor Cas., Roscommon  
 Caulton, John T... Lighthorn, Warwick  
 Causton, Joseph... Champion Hill, Camberwell, S.  
 Cavan, Col. P. C. Longparish, Whitechurch, Hants  
 Cave, Henry Haddon... Desborough, Kettering  
 †Cavendish, Hon. Capt. G., R.N... Chertsey  
 Cavendish, Lt. G.H., M.P... 3, Up.Eccleston St., S.W.  
 Cavendish, Lt.-Col. W. H. F... Ayot St. L., Welwyn  
 Cawdor, Earl of... Stackpole Court, Pembroke  
 Cawley, Thomas... Nantwich  
 Cawton, Wm... Somersall Hall, Chesterfield  
 Cayley, Sir Digby, Bart... Brompton, York  
 Cazalet, Rev. W. W... Pinner  
 Chadwick, Edward...  
 Chadwick, E., C.B... 5, Montague Vil. Richmond, Sur.  
 †Chadwick, Elias... Pudleston Court, Leominster  
 †Chadwick, F... The Hermitage, Grimsargh, Preston  
 Chadwick, Joseph... Kirkstall, Leeds  
 Chadwick, T... Wilmslow Grange, Cheshire  
 Chadwick, William... Burlish Lodge, Stourport  
 †Chafy, Westwood W... Bowes House, Ongar  
 Chalcraft, Thomas... Millhall Cottage, Alton  
 Chalcraft, William... Bramshot House, Liphook  
 Chalk, Thomas... Barbourne, Worcester  
 Challenor, John... Blackwood, Leek  
 Chaloner, Capt. Thos., R.N... Longhull, Guisboro.  
 Chamberlain, Henry, jun... Bredicot Court, Worcester  
 †Chamberlayne, Thos... Cranbury Pk., Winchester  
 Chambers, George... High Green House, Sheffield  
 Chambers, John... The Hurst, Tibshall, Alfreton  
 Chambers, Thomas, jun... Colkirk, Fakenham  
 †Chambers, Wm... Hafod, Rhayader  
 Champney, Wm. W... Calcot, Reading  
 Champney, Felix... Gatwick, Crawley, Sussex  
 Champneys, Rev. T. P... Badsworth, Pontefract  
 Chandler, Henry... Salford, Manchester  
 Chandler, Thomas... Aldbourne, Hungerford  
 Chaplin, Frederick... Taithwell, Louth  
 Chapman, J. W... Moggaddy Farm, Maynooth  
 Chapman, R. H... Upton, Nuneaton  
 Chapman, Thos... 23, New St., Spring Gardens, S.W.  
 Chapman, William... 1, Neale Street, Ipswich  
 †Charlesworth, J... Headfield, Dewsbury, Yorkshire  
 †Charley, Richard... Cleobury North, Bridgenorth  
 †Charlton, St. John... Hillfields, Bewdley  
 †Charlton, St. J. C... Apley Cas., Wellington, Salop  
 Charlton, Wm... Bulman Village, Newcastle-on-Tyne  
 Charlton, W. H... Hesleyside, Hexham  
 Chasemore, Philip... Horsham  
 Chaundler, Robert James... Crondall, Farnham  
 Chawner, Henry... Hound Hill, Uttoxeter  
 Chawner, Richard... Hare Hill, Doveridge, Derby]

†Chawner, Richard Croft... The Abnalls, Lichfield  
 Cheere, Rev. G... Papworth Hall, St. Ive's, Hunts  
 Cheere, W. H... Papworth Hall, Caxton, Cambridge  
 Cheffins, Henry... Little Easton Manor, Dunmow  
 Cheney, Edward... Gadsley Hall, Melton Mowbray  
 Cheney, R. H... Badger Hall, Shiffnal, Shropshire  
 †Cherry, Geo. Charles... Denford, Hungerford  
 †Chesham, Lord... Latimer, Chesham  
 Chesterfield, Countess of... Bretby Pk., Burton-on-Tr.  
 Chetwode, Sir J. N. L., Bart... Market Drayton  
 Chetwynd, Sir G., Bart... Grendon Hall, Atherstone  
 Chetwynde, Major W. F... Brocton Hall, Stafford  
 Chichester, Bishop of... The Palace, Chichester  
 Chick, John... Compton Vallence, Dorset  
 Chick, John... Whitwell, York  
 Chick, Thomas... Stratton, Dorchester, Dorset  
 Child, Coles... The Palace, Bromley, S.E.  
 Child, Thomas... Slinfold, Horsham  
 Chinery, John... Wootton Milton, Lymington  
 Chittenden, James... Hope All Saints, New Romney  
 Chittenden, John... Newchurch, New Romney  
 Chitty, Edward... Guildford  
 Chivas, George... Chester  
 †Cholmondeley, Lord H... Holly Hill, Southampton  
 Cholmondeley, Col. Hon. G... Abbott's Moss  
 Chrisp, Thomas... Hawkhill, Alnwick  
 Christian, John... Barrow House, Oakham  
 Christy, James, jun... Boynton Hall, Chelmsford  
 Church, John... Woodside, Hatfield  
 †Churchill, George... Aldershot, Fordingbridge  
 †Churchill, Lord... Wychwood Park, Oxon  
 Churchill, H... Barton Ho., Morchard Bishop, Devon  
 †Churston, Lord... Lupton, Torquay  
 †Churton, John... Foregate Street, Chester  
 Chute, W. L. Wiggett... The Vine, Basingstoke  
 Clare, Charles L... Higher Broughton, Manchester  
 Clare, W. Harcourt... Twycross, Atherstone  
 †Clarence, John...  
 Claridge, William P... The Parks, Loughborough  
 †Clarina, Lord... Elm Park, Limerick, Ireland  
 †Clark, H... Ellinthorpe Hall, Boroughbridge, Yorks.  
 Clark, James... View Lawn, Longhorsly, Morpeth  
 Clark, Rev. John Crosby... Chertsey  
 Clark, John Wm... Belkins, Romsey, Hants  
 Clark, Joseph H... Attwood House, Maidenhead  
 Clark, Thomas... Derndale, Hereford  
 Clark, William... Hepscott Hall, Morpeth  
 Clark, William J... 2, Royal Crescent, Brighton  
 †Clarke, C... Ashby-de-la-Lound, Sleaford, Linc.  
 Clarke, Edward... White Ho., Bracebridge, Lincoln  
 Clarke, Edw... Glebeland House, Lee, Kent  
 †Clarke, James... Carlisle  
 Clarke, G. R... Chelsterton Lodge, Bicester  
 Clarke, Henry... Binbrooke, Market Rasen  
 Clarke, John... Long Sutton  
 Clarke, J. Goff... Brackley, Northampton  
 Clarke, Jno. William... Cambo, Newcastle-on-Tyne  
 Clarke, Nathaniel... Beamish Park, Fence Houses  
 Clarke, Robt. B... Haynes Hill, Barbadoes  
 †Clarke, T. E... Tremlett House, Wellington, Som.  
 Clarke, Thomas T... Swakeleys, Uxbridge  
 Clarke, William... Brack Farm, Luton  
 Clarke, W. B... Berwickstead, Beckermest, Whiteh.

- Clarkson, Thos... Playford Hall, Ipswich  
 Clarkson, Rev. T. L.... South Elmham, Norfolk  
 †Clavering, Sir W., Bt... Univ. Club, Suffolk St., S.W.  
 Clay, Charles... Walton Grange, Wakefield  
 Clay, Charles, Whitechurch, Salop  
 †Clay, Sir W., Bart... Fulwell Lodge, Twickenham  
 Clay, William D.... St. Aston House, Lutterworth  
 Clayden, John... Littlebury, Saffron Walden  
 †Clayden, John C.... Littlebury, Saffron Walden  
 Clayden, Samuel... Linton, Cambridgeshire  
 Clayton, David S.... Norbury, Stockport  
 Clayton, H.... 21, Upper Park Place, Dorset Sq., N.W.\*  
 Clayton, John... Newcastle-on-Tyne  
 Clayton, John... Hook, Kingston, S.W.  
 †Clayton, Nathaniel... Melville Street, Lincoln  
 Clayton, R. C. B. Carigbyrne, Adamstouse, Enniscomorthy  
 Clayton, T. G... Thorpe Arch Hall, Tadcaster  
 Cleasby, John H.... High Heworth, Gateshead  
 Cleasby, R. H.... Broomside House, Durham  
 Cleasby, Thomas M.... Wilton Grange, Redcar  
 Cleave, Benjamin... Newcombe, Crediton  
 Clements, C. F.... Hesmond's Lodge, East Hothly  
 †Clerk, E. H.... Burford, Shepton Mallet, Somersets.  
 Cliffe, Thomas... Crew Gates, Crewe  
 Clifford, Henry Clifford... Frampton Court, Dursley  
 Clifford, Col. H. M.... Llantilio, Coseney, Ragland  
 Clifford, William... 52, Parliament Street, S.W.  
 †Clinch, Charles... Eagle Brewery, Witney  
 Clinton, Charles H. Fynes... Whitefriars, E.C.  
 Clinton, Col. Fred... Ashley Clinton, Lymington  
 Clinton, Lord... Hinton House, Crediton, Devon  
 Clive, Hon. Capt. G. W., M.P... 53, Grosvenor St., W.  
 Clive, George, M.P... Penistone, Ross, Herefords.  
 †Clonbrock, Lord... Clonbrock, Asherah, Ireland  
 Clough, John... Bootham, York  
 †Clowes, Edmund... Carnforth, Lancaster  
 Clowes, George... Duke Street, Stamford Street, S.  
 Clowes, Wm... 51, Gloucester Ter., Hyde Park, W.  
 Clowes, Col. W. L. ... Broughton Old Hall, Manch.  
 Clutterbuck, Rev. J. C... Long Wittenham, Abingdon  
 Clutterbuck, R... Watford Ho., Watford, Herts  
 Clutterbuck, T... Warkworth, Aclington, Northumb.  
 Clutton, John... 9, Whitehall Place, S.W.  
 Clutton, Robert... Hartswood, Reigate, Surrey  
 Clutton, Robt. G... 9, Whitehall Place, S.W.  
 Clutton, Wm... Portland Villa, S. Norwood  
 Clutton, Wm. James... The Mount, York  
 Cobb, Frederick... Walton, Warwick  
 Cobb, Geo. Henry... Greenwich  
 †Cobb, Henry... 26, Lincoln's Inn Fields, W.C.  
 Cobb, Robert L... Higham, Rochester  
 Cobb, Thomas... Radnor Cliff Villa, Sandgate  
 Cobb, Timothy Rhodes... Banbury, Oxon  
 Cobb, William Henry... Colchester  
 Cobbett, John M., M.P... Skeynes, Edenbridge  
 Cobbold, John Chevallier, M.P... Ipswich  
 Cobden, Richard, M.P... Midhurst  
 Cobon, James... Well Hall, Lynn, Norfolk  
 †Cochrane, Archd. H... Langton Grange, Darlington  
 Cochrane, James... Harburn, Edinburgh  
 Cochrane, Wm... 31, West Parade, Newcastle-on-T.  
 †Cocks, Rev. C. R. Somers... Cleobury Mortimer  
 Cockledge, James... Stowmarket  
 Codd, Henry... Ashe, Micheldever  
 Cohen, Wm... Chestnuts, Figs Marsh, Mitcham, S.  
 †Coke, Hon. E. K... Longford Hall, Derby  
 Colby, S. E... Havod Grove, Cardigan  
 Coldham, H. W... Anmer, Lynn, Norfolk  
 †Cole, R. J...  
 Cole, Thomas H... The Green, Wick, Bath  
 Cole, Wentworth L... Cirencester  
 Coleman, John... South Fields, Wandsworth, S.W.  
 Coleman, John... Park Farm, Woburn, Beds  
 Coleman, Richard... Langdon Abbey, Dover  
 Coleman, Richard... Chelmsford  
 Coleman, Walter, Kingsbury Hall, Tamworth  
 †Coles, Alfred... Clifton Lodge, Clapham Park, S.  
 Collier, W. F... Woodtown, Tavistock  
 Collin, Rev. J., jun... Rickling Vicarage, Herts  
 Collings, Rev. William T... Guernsey  
 Collingwood, E... Dissington Hall, Newc-on-Tyne  
 Collins, Barnabas... Hunston, Ixworth  
 †Collins, Henry... 38, Lincoln's Inn Fields, W.C.  
 †Collins, John... Wonham, Bampton, Devon  
 Collins, Wm... Aston Farm, Stafford  
 Collison, William... Beverley  
 Collyer, Rev. Canon R... Warham Rect., Wells, Norf.  
 Colquhoun, J. C... Chartwell, Westerham  
 †Colyer, William... North End, Crayford, Kent  
 Colthurst, John... Chew Magna, Bristol  
 Colthurst, J. C... Huntworth Pk. Farm, Bridgwater  
 Colville, Rev. A. A... Livermere Rectory, Bury St. Ed.  
 Colville, Lieut.-Gen... Kempsey House, Worcester  
 Colville, C. R., M.P... Lullington Hl., Burton-on-Tr.  
 †Colvin, B. B... Monkhams Ha., Waltham Abbey, N.  
 Combe, R. H... Pierrepoint, Frensham, Farnham  
 Combermere, Visc... Combermere Abbey, Nantwich  
 †Compton, H. C., M.P... Lyndhurst, Hants  
 †Compton, R... Eddington House, Hungerford  
 †Condie, James... Perth  
 Coney, William... Battenhall, Worcester  
 †Congreve, S. B... Harbors Magna, Rugby  
 †Congreve, T... Leamington Hastings, Rugby  
 †Congreve, W... Comb Fields, Brinklow, Coventry  
 Conington, Clement... Hagworthingham, Spilsby  
 †Constable, Sir Clifford, Bt... Burton Constable, Hull  
 Constable, Rev. J... R. A. College, Cirencester  
 Conway, Wm. S... Bodryddan, St. Asaph's, Flintsh.  
 Cooch, Joshua... Harleston, Northampton  
 Cook, George... Flitwick, Amptill  
 Cook, George... 22, Aberdeen Park, Highbury, N.  
 †Cook, John... Hothorpe, Welford, Northamptonsh.  
 Cook, Richard Samuel... Pailton Lodge, Lutterworth  
 Cook, William... Hexham  
 Cooke, B. G. D... Colomendy, Mold  
 Cooke, Grimwood... Linton, Cambridgeshire  
 †Cooke, Henry... High Street, Hereford  
 Cooke, James H... Berkeley Castle, Gloucestershire  
 Cooke, Rev. James Y... Semer, Ipswich  
 Cooke, Robert C... Livermere, Bury St. Edmund's  
 Cooke, William, C.E...  
 Cooke, William... Stanford, Worcester  
 †Cooke, Wm. Fothergill...  
 Cookes, Jno. R... Woodhampton House, Stourport  
 Cookson, John... Meldon Park, Morpeth  
 Cookson, G. J... Benwell Tower, Newcastle-on-Tyne

Cookson, N. C. . . Benwell Tower, Newcastle-on-Tyne  
 Cookson, W. J. . . Benwell Tower, Newcastle-on-Tyne  
 Coombs, T. . . . South Street, Dorchester, Dorset  
 Cooper, Benjamin . . . . Pattingham, Wolverhampton  
 †Cooper, C. B. . . . The Manor, Micheldever, Hants  
 Cooper, Edward . . . . Henley-in-Arden  
 Cooper, Edwd. H. . . . Markree Castle, Collooney, Sligo  
 Cooper, G. Kersey . . . . Euston, Thetford  
 Cooper, Henry Reeve . . . . Britwell, Watlington, Oxon.  
 Cooper, John . . . . Swineshead House, Spalding  
 Cooper, Jonathan . . . . Barton, Bury St. Edmund's  
 Cooper, Joseph . . . . Redmarley, Newent  
 †Cooper, N. J. . . . Westgate, Mansfield  
 Cooper, Rous John . . . . Blythburgh Lodge, Halesworth  
 Cooper, W. W. . . . Barnham, Thetford  
 Coote, George . . . . Smeetham Hall, Sudbury  
 †Coote, E. (11th Hussars) . . . . West Pk., Fordingbridge  
 Coote, Geo. Cosens . . . . Tortington, Arundel  
 Copeman, George . . . . Dunham Lodge, Swaffham  
 Copeman, Robert, jun. . . . Hemsley, Great Yarmouth  
 Copestake, Thos. G. . . . Kirk Langley, Derby  
 †Coppard, T. . . . Lanehurst Lodge, Hurstpierpoint  
 Corbet, H. . . . Central Farmers' Club  
 †Corbet, H. R. . . . Adderley Hall, Market Drayton  
 Corbett, James . . . . Croome Dabotop, Severn Stoke  
 †Corderoy, Edward . . . . Clapham Park, S.  
 Corles, Edward . . . . The College Green, Worcester  
 Corner, Edward . . . . Esk Hall, Whitby  
 Corner, J. B. . . . Longforth, Wellington, Somerset  
 Corner, Richard . . . . Torweston, Williton, Taunton  
 Cornes, James . . . . Barbridge, Nantwich  
 Cornwall, Sir V., Bart. . . . Moccas Court, Hereford  
 Corringham, R. W. . . . Pound House, Haxey, Bawtry  
 Coryton, Augustus . . . . Pentillie Castle, Cornwall  
 Cosens, William . . . . Langdon, Dawlish, Devon  
 Cotes, Rev. C. G. . . . Stanton St. Quintin, Chippenham  
 Cother, William . . . . Middle Aston, Woodstock  
 Cottam, George H. . . . Old St. Pancras Road, N.W.  
 Cotterell, Sir H. G. Bart. . . . Garnons, Hereford  
 †Cotterell, Jacob Henry . . . . 6, Terrace Walks, Bath  
 Cottingham, John G. . . . Chatsworth, Chesterfield, =  
 †Cotton, Alexander . . . .  
 Cotton, H. . . . Amor Hall, Washbrook, Ipswich  
 Cotton, H. P. . . . Quex Park, Isle of Thanet  
 Cotton, Maj.-Gen. T. Conyers . . . . Cilindre, Ruabon  
 †Cotton, Lt.-Col. Hon. W. H. S. . . . Malpas, Cheshire  
 †Couchman, C. . . . Temple, Balsall, Birmingham  
 Couchman, J. W. . . . Tottenham Green, N.  
 Coulman, Edward . . . . The Levels, Thorne, Yorkshire  
 Coulman, John . . . . Red House, Thorne  
 Coulson, John . . . . Killingworth, Newcastle-on-Tyne  
 Coulson, Robert C. . . . Burnigill House, Durham  
 Coultas, James, jun. . . . Spittlegate, Grantham  
 †Coulthard, G. . . . Lanercost Abbey, Bampton, Cum.  
 Coupland, John G. . . . Freeston, Boston  
 †Court, P. Simpson . . . . 140, Snargate Street, Dover  
 Courthope, G. C. . . . Whiligh, Hurst Green  
 Coussmaker, Lannoy . . . . Westwood, Farnham, Surrey  
 Coventry, Earl of . . . . Croome Court, Kempsey  
 Coverdale, John . . . . 4, Bedford Row, W.C.  
 Cowen, Joseph . . . . Stella Hall, Blaydon-on-Tyne  
 Cowen, J. jun. . . . Stella House, Blaydon-on-Tyne  
 †Cox, Henry . . . . Trevereux, Edenbridge, Kent

Cox, Joseph . . . . Wisbeach  
 Cox, Samuel Walker . . . . Spondon Cottage, Derby  
 Cox, William . . . . Brailsford, Derby  
 Cox, Wm. Thos. . . . Spondon Hall, Derby  
 †Coxe, James . . . . Newtown Lodge, Hungerford  
 Coxon, John . . . . Treeford Farm, Lichfield  
 Coyney, C. . . . Weston Coyney, Longton, Staffordsh.  
 Crane, Edward . . . . Forton, Montford, Shrewsbury  
 Crane, James . . . . Tolpuddle, Dorchester  
 Crane, James . . . . Shrawardine, Salop  
 Cranke, John . . . . Fountain Street, Ulverstone  
 †Cranston, Thomas . . . . Little Dilwyn, Leominster  
 Crawford, John . . . . Lumley Park, Fence Houses  
 Crawford, Thomas . . . . North Shields  
 Crawford, Rev. W. H. . . . Haughey Park, Woolpit  
 Crawford, Wm. H. . . . Lakelands, Cork  
 †Crawley, John S. . . . Stockwood Park, Luton  
 Crawshall, Isaac . . . . Nun Monkton, York  
 †Crawshay, Edwd. . . . Orthorpe Ho., Market Harboro'  
 Creese, William . . . . Teddington, Tewkesbury  
 Cressingham, Jonah . . . . Carshalton, S.  
 Cresswell, A. J. Baker . . . . Cresswell, Morpeth  
 Cresswell, Gerard O. . . . Sedgford Hall, King's Lynn  
 Cresswell, R. W. . . . Ravenstone, Ashby de-la-Zouch  
 Crewe, Sir J. H., Bart. . . . Calke Abbey, Derby  
 Crisp, Arthur William . . . . Deepgrave Hall, Woodbridge  
 Crisp, Edward, M.D. . . . 42, Beaufort Street, S.W.  
 †Crisp, Thomas . . . . Butley Abbey, Wickham Market  
 †Croft, Arthur H. . . . Hutton Buscel, York  
 Croft, Rev. Archdeacon J. . . . Saltwood, Hythe, Kent  
 †Croft, Sir John, Bart. . . . Kingsdown, Sittingbourne  
 †Crofton, Lord . . . . Mote Park, Athlone, Ireland  
 †Crofts, Rev. C. D. . . . Caythorpe Rectory, Grantham  
 Crofts, John . . . . Long-Lawford Hill, Rugby  
 Crofts, T. W. . . . Stoneleigh Terrace, Coventry  
 Crompton, George . . . . Chesterfield  
 Croome, James . . . . Breadstone, Berkeley, Gloucesters.  
 Croome, J. Capel . . . . Cerney House, Cirencester  
 Croote, G. H. . . . Crooke, North Tawton, Devon  
 Crosbie, Wm. T. . . . Ardferit Abbey, Tralee, Ireland  
 †Cross, Wm. A. . . . Red Scarr, Preston, Lancashire  
 Crosse, Thomas B. . . . Shaw Hill, Chorley  
 Crosskey, John . . . . Lewes  
 Crosskill, Alfred . . . . The Iron Works, Beverley  
 †Crossley, Sir F., Bt., M.P. . . . Somerleyton, Lowestoft  
 Crosthwaite, John . . . .  
 †Crow, G. . . . Ornhams, Boroughbridge, Yorkshire  
 Crowley, John L. . . . Standford Hall, Newport, Salop  
 Croxon, John . . . . Llanoorda Isaf, Oswestry  
 †Crump, G. W. . . . Woollas Hill, Eckington, Pershore  
 Crump, Thomas . . . . Whitefield, Tewkesbury  
 Crundwell, George . . . . 14, Ashford Road, Maidstone  
 Cruso, John . . . . Leek, Staffordshire  
 Crutchley, P. H. . . . Sunninghill Park, Staines  
 Cuff, J. H. . . . New Cattle Market, Islington, N.  
 †Cuff, W. Fitchett . . . . Merriott, Ilminster  
 Culley, John . . . . Easton, Pewsey, Wilts  
 Culverwell, Jas. . . . Wedmore, Weston-super-Mare  
 Cumberbatch, L. . . . Queen's House, Lyndhurst  
 †Cumming, L. . . . Ratten, Thurso, N.B.  
 Cunningham, Capt. R. D. B. . . . Hensol, Castle Douglas  
 Cuninghame, John . . . . Hensol, Castle Douglas, N.B.  
 †Cure, Capel . . . . Blake Hall, Ongar, Essex



Cureton, George... Bean House, Shrewsbury  
 Currie, Edmund... Adbury House, Newbury  
 Currie, Henry... West Horsley Park, Leatherhead  
 Currie, Raikes... Minley Manor, Farnboro'  
 Currie, Wm. Pitt... Gt. Vaynor, Narberth, Pembroke  
 Curtis, Capt. C.... Pailton House, Lutterworth  
 Curtis, Charles E.... Alton  
 Curtis, E.... Dummer Grange, Basingstoke  
 Curtis, Frederick Thos... Elmstone Court, Sandwich  
 Curtis, Thomas... The Hall, Berkhamstead  
 †Curtis, Sir Wm., Bart.... Caynham Court, Ludlow  
 Curtler, T. G.... Bevere House, Worcester  
 Curzon, Hon. S. C. H. R.... Grove Ho., Tooting, S.  
 Cust, Capt. F. Henry... Ellesmere  
 Custance, Hambleton F.... Weston House, Norwich  
 Cuthbert, Robert... Newton-le-Willows, Bedale  
 †Cuthbert, William... Beaufront, Hexham  
 Cutting, Robert Coote... Ridlington Uppingham

## D.

Dacre, Lord... The Hoo, Welwyn, Herts  
 †Dacre, Joseph... Kirklington Hall, Carlisle  
 Dalgairns, William... Rosaire, Guernsey  
 Dalton, James... Fillingham Manor, Lincoln  
 Dalton, Thomas... Cardiff  
 Danger, Thomas... Huntstile, Bridgewater  
 Daniel, Charles R.... Claydon, Bawtry  
 Daniel, Thomas... Stoodley, Tiverton  
 †Darbshire, S. D.... Pendyffryn, Conway  
 Darby, George... Marklye, Warbleton, Hurst Green  
 †Darby, Abraham... Stoke Court, Slough  
 †Dare, F. M. Hall...  
 Dare, R. W. Hall... Newtownbarry, Ireland  
 Darley, Chas. Albert... Burtonfield, York  
 †Darling, J.... Beau Desert, Rugeley  
 Darling, Robt... Plawsworth, Fence Houses  
 Darnbrough, Thos. S.... South Otterington, Thirsk  
 Darvill, Henry... Windsor  
 †Dashwood, F. Loftus... Kirtlington Park, Oxon  
 Dashwood, Sir Henry W., Bt.... Kirtlington, Oxford  
 †Dashwood, M.... 9, Seamore Place, Mayfair, W.  
 Daubeney, Edmund J.... Cleve House, Yatton, Somers.  
 Daubeney, Rev. E. A.... Ampney, Cirencester  
 Daubeney, R.... King's Bench Walk, Temple, E.C.  
 Davey, George... Buckland, Faringdon  
 Davey, Richard, M.P.... Redruth, Cornwall  
 David, Edward... Fairwater House, Cardiff  
 David, Evan William... Radyr Court, Cardiff  
 Davidson, James... 125, High Street, Gateshead  
 Davie, Sir H. Ferguson, Bt., M.P... Creedy, Crediton  
 Davie, J. Thornton... Hepscott Red House, Morpeth  
 Davies, D. Price... Troedybryn, Llandilo  
 Davies, D. R.... Mere Old Hall, Knutsford  
 †Davies, E. H.... Hampton Bishop, Hereford  
 Davies, Rev. J.... Moor Court, Herefordshire  
 Davies, John Morgan, Froodvale, Llandillo  
 Davies, Rev. R. T.... Crickhowell, Brecknockshire  
 Davies, Richard... Aylestone Hill, Hereford  
 Davies, Robert C.... Southminster, Maldon  
 Davies, Robert J., Cwrtmaur, Llangeitho, Cardigan

†Davies, Robt. P.... Ridgeway, Narberth, S. Wales  
 Davies, Mrs. Susanna... Rochlveston Manor, Notts  
 Davies, Thomas... Burlton Court, Burghill, Hereford  
 Davies, Rev. W. I. K.... Croft Castle, Leominster  
 Davis, Henry... Old Downs, Oakhill, Bath  
 Davis, James... Melcombe Horsey, Blandford  
 †Davis, John... Cranbrooke, Ilford, E.  
 Davis, Peter... Bickmarsh Hall, Alcester  
 †Davis, R.... 9, St. Helen's Place, Bishopsgate, E.C.  
 †Davis, R. F....  
 †Davis, R. S. B.... Swerford Park, Enstone, Oxon  
 †Davis, Samuel... Swerford Park, Enstone, Oxon  
 †Davis, Thos. Henry... Orleton, Worcester  
 Davis, T.... Little Wenlock, Wellington, Shropshire  
 Davison, John... Tritlington, Morpeth  
 Davison, John, jun... Tritlington, Morpeth  
 Davison, Robert S.... Newburn, Blaydon-on-Tyne  
 Davison, John Perry... Easton Maudit, Northampton  
 Davison, Richard... Driffield  
 Davison, Michael... Long Bank, Alnwick  
 Davison, Joseph... Greencroft, Durham  
 Davey, Jas.... Flitton-Barton, South Molton  
 †Davey, J. S.... Redruth, Cornwall  
 Davey, Robert... Ringwood, Hampshire  
 Davy, John T.... Barton Roseash, South Molton  
 Dawes, John S.... Smethwick House, Birmingham  
 Dawkins, E. H. F.... Moggerhanger Ho., St. Neot's  
 Dawson, Edward... Aldcliffe Hall, Lancaster  
 Dawson, J.... Gronant, Rhyl, Flintshire, N.W.  
 †Dawson, Wm. Edward... Plumstead Common, S. E.  
 †Day, Charles... Colleyweston, Stamford  
 Day, John... Newick Lodge, Uckfield  
 Day, Samuel... St. Neot's  
 †Day, William... Woodvates, Salisbury  
 †Deacon, John... Mabledon, Tonbridge  
 †Dean, A. K.... East Brent, Axbridge, Somerset  
 †Dean, F. K.... East Brent, Axbridge, Somerset  
 Deane, F. H.... Eastcot, Ruislip, Watford  
 Deane, Rev. Henry... Gillingham, Dorset  
 Deane, William Anthony... Webbery Ho., Bideford  
 Dearden, James... Poole  
 Death, Ambrose... Lawshall, Suffolk  
 †De Curzay, Visct... Château de Curzay, Lusignan  
 Deedes, Major G.... Hillhurst Farm, Hythe  
 Deedes, William... Sandling Park, Hythe  
 †Dees, James... Whitehaven  
 †Dees, Robert R.... Wallsend Hall, Newcastle-on-T.  
 De L'Isle and Dudley, Lord... Penshurst Park, Kent  
 Delves, William... Frant, Tonbridge Wells  
 De Mauley, Lord... Down Ampney, Cirencester  
 †Demidoff, Prince... Florence  
 †Denbigh, Earl of... Newnham Paddock, Lutterworth  
 Denchfield, J.... Aston Abbots, Aylesbury  
 Denison, Edmund... Doncaster  
 †Denison, Sir W., Bart.... New South Wales  
 Denison, W. Beckett... Burley, Leeds  
 Denman, Lord... Middleton Hall, Bakewell  
 Denne, Wm.... Three Counties Asylum, Baldock  
 †Dennett, Mullens... Lodswoth, Petworth, Sussex  
 Dennis, John Chas.... Rosebrough, Northumberland  
 Dennis, Robert... Greatham, Horncastle  
 Denson, Samuel... Picton Hall, Cheshire  
 †Dent, John Couchner... Sudely Castle, Winchcombe



Dent, John D., M.P....Ribstone Hall, Wetherby  
 Dent, Joseph...Ribstone Hall, Wetherby  
 Dent, Joseph...Neasham Hall Farm, Darlington  
 Dent, Ralph...Streatham Castle, Barnard Castle  
 †Dent, Wilkinson...Flass Ho., Kirkby Thore, Penrith  
 Denton, A. Bailey....Stevenage, Hertford  
 De Rothschild, Sir A., Bt....Aston Clinton, Tring  
 Derry, C. E....Farmers' Club, Newcastle-on-Tyne  
 De Salis, Rev. H. J....Fringford Rectory, Bicester  
 Dester, Wm....Seckington, Tamworth  
 †De Trafford, Sir H., Bt. . .Trafford Pk., Manchester  
 Devas, Charles F....Bromley Lodge, Kent, S.E.  
 Devas, Thomas....Mount Ararat, Wimbledon, S.W.  
 Devas, William...Woodside, Old Windsor  
 Deverell, John...Purbrook Park, Portsmouth  
 Devincenzi, Signor Giuseppe...  
 Des Vœux, Sir H., Bt....Drakelow Pk., Burton-on-Tr.  
 †De Vitre, H. D....Charlton House, Wantage  
 †Devon, Earl of...Powderham Castle, Exeter  
 Devon, Chas...St. Vincent's, Haddington, Maidstone  
 Dew, Tomkyns...Whitney Court, Hereford  
 Dewar, William...Middleton, Bicester  
 Dewe, Wm. T....Manor House, Coates, Cirencester  
 †De Wezele, Count G....55, Eaton Square, S.W.  
 †Dewing, R....Carbrooke, Watton, Norfolk  
 De Winton, J. P....  
 Deykin, James, jun....Whiston, Penkridge  
 Diamond, James....Beer Alston, Tavistock  
 †Dickens, Charles Scrase...Horsham  
 Dickin, John...Tyndwif, Langollen  
 Dickin, Richard...161, Old Road, Stockport, Lanc.  
 Dickinson, W. F. D....Ulverston, Lancashire  
 Dickens, R. A....Woodford Grange, Wolverhampton  
 Dickinson, H....Severn Ho., Colebrookdale, Salop  
 †Dickinson, E. H....King's Weston, Somerton  
 Dickinson, John...Abbott's Hill, Watford, Herts  
 Dickinson, William...New Park, Lymington  
 †Dickons, Thomas...High Oakham, Mansfield  
 Dickson, Arthur...Queen's Park, Chester  
 Dickson, James...Chester  
 Digby, G. D. Wingfield...Sherborne Castle, Dorset  
 Digby, Lord...Minterne House, Dorchester, Dorset  
 Digby, Rev. K....Tetteshall Rectory, Litcham, Norf.  
 Digby, Lt.-Col. R...6, Chapel St., Grosvenor Sq., W.  
 Dilke, Sir C. Wentworth, Bt....76, Sloane St., S.W.  
 †Dilke, Charles W....76, Sloane Street, S.W.  
 †Dillon, Viscount...Dytchley Hall, Enstone, Oxon  
 †Dinning, J. . .Adderstone, Belford, Northumberland  
 Dinning Joseph...Langley Hill Top, Haydon Bdge.  
 Disney, Edgar...The Hyde, Ingatestone  
 Disraeli, Rt.Hn. B., M.P....Hughenden Man., Bucks  
 Divett, John...Bovey Tracey, Devon  
 Dix, George Weatherstone...Howden, Yorkshire  
 Dixie, E. W....Wenhaston Grange Halesworth  
 †Dixon, George M....Bucknowle House, Wareham  
 Dixon, Henry...Frankham, Tunbridge Wells  
 Dixon, Henry Hall...10, Kensington Square, W.  
 Dixon, Hugh...5, India Buildings, Liverpool  
 Dixon, Isaiah...Grove Terrace, Leeds  
 Dixon, John...Harmston, Lincoln  
 Dixon, J. T....Dunterley, Bellingham, Hexham  
 †Dixon, John W....Caistor, Lincolnshire  
 Dixon, Peter...Holme Eden, Carlisle

Dixon, Thos. John...Holton, Caistor, Lincolnshire  
 †Dixon, Thos. Parkinson...Caistor, Lincolnshire  
 Dixon, Wm. F....Page Hall, Sheffield  
 Dobinson, Francis...Wildeswick Ho., E. Grimstead  
 Dobito, George...Lidgate, Cropley Gro., Newmarket  
 Docker, Ludford...Paul's Hill, Leigh, Tunbridge  
 †Dod, Whitehall...Llanerch, St. Asaph  
 Dod, J. W., M.P....Cloverley Hall, Whitchurch, Salop  
 Dodd, Henry...The Riding, Hexham  
 Dodds, P. A....Howard Street, North Shields  
 Dods, T. P....Anick Grange, Hexham  
 †Dodson, Charles E....Littledale Hall, Lancaster  
 Dodwell, J....Manor House, Long Crendon, Thame  
 Doggett, Thomas William...Sandon, Royston  
 Dolphin, T....Swafeld, North Walsham, Norfolk  
 Donald, Adam...Grainger St., Newcastle-on-Tyne  
 Donald, W....St. James's Hall, Regent Street, W.  
 †Doneraile, Viscount...Doneraile Court, Co. Cork  
 Donkin, David...St. James' St., Newcastle-on-Tyne  
 Donkin, Robert...Felton, Acklington, Northumber.  
 Donkin, Samuel...Bywell, Felton, Northumberland  
 †Donovan, George (49th Regt.)...  
 Donovan, J. C....Gatwick, Mill Hill, Billericay  
 Dorrell, Thomas...Bishampton, Pershore  
 Dorrington, C....Bridehall Farm, St. Albans  
 Dormer, C. Cottrill...Rousham, Woodstock, Oxon  
 †Dorrien, C....Ashdean, Funtlingdon, Chichester  
 Doubleday, E....Long Clawton, Melton Mowbray  
 Douglas, James...Athelstaneford, Drem, N.B.  
 Dowden, Thomas...Roke Farm, Bere Regis  
 †Dowdeswell, G. M...Park Gate Ho., Catsfield, Battle  
 Dowding, Edwyn...15, Vineyards, Bath  
 Downing, J. B....Holme Lacey, Hereford  
 Downing, William...Lemington, Blaydon-on-Tyne  
 Downs, Henry...Manor House, Basingstoke  
 Downs, J. H....Grove Lodge, Fulham, S.W.  
 Downward, Rev. George R....Shrewsbury  
 Downward, John...Hampton Hall, Malpas  
 Drake, Sir T. T. F. E., Bart...Nutwell Court, Exeter  
 †Drake, T. Tyrwhitt...Shardloes, Amersham  
 Drakeford, David...Dillions, Crawley, Sussex  
 Draper, Charles...Kenilworth  
 Draper, J. S....Thingehill, Hereford  
 †Drax, J. S. W. Erle, M.P....Charborough Pk. Blandford  
 Dray, William...Farningham, Kent  
 †Drew, Edw...Calcot, Kingscote, Wotton-under-Edge  
 Drew, Henry...Exe View, Aliphington  
 †Drewe, E. Simcoe...The Grange, Honiton  
 †Drewitt, George...Manor Farm, Oving, Chichester  
 Drewitt, Henry...Milvill Farm, Titchfield  
 Drewitt, John...North Stoke, Arundel  
 †Drewitt, R. Dawtrey...Peppering, Arundel  
 Drewitt, Thomas...Piccard's Farm, Guildford  
 Drewry, George...Newton-in-Cartmel, Lancashire  
 Drinkwater, Fred...Madley, Hereford  
 Driver, Robert Collin...4, Whitehall Place, S.W.  
 †Druce, A. F. Milton...Burghfield, Reading  
 †Druce, Joseph...Eynsham, Oxford  
 †Druce, Samuel...Eynsham, Oxford  
 †Drummond, A. R....Cadland, New Forest, Hants  
 Drummond, Dr. H...15, Westbourne Terrace, W.  
 Dryden, Thomas...The Kennels, Haydon Bridge  
 Ducane, Chas., M.P....Braxted Park, Witham

Duckham, T.... Baysham Court, Ross, Herefordshire  
 †Duckworth, Sir J., Bart.... Wear House, Exeter  
 †Duckworth, Russell.... Murtrey Hill, Frome  
 Dudding, Thomas.... Pockerby, Goole  
 Dudfield, Benjamin.... Spetchley, Worcester  
 Dudin, John B.... Hayes Grove, Bromley, S.E.  
 Duffield, James.... Great Baddow, Chelmsford  
 Dufty, Thomas.... Knapthorpe, Newark  
 Dugdale, W. Douglas.... West Chaldon, Dorchester  
 Duggan, H. Stephens.... Hereford  
 Duke, Henry.... Broadmain, Dorchester, Dorset  
 Duke, Stephen.... Blakehurst, Arundel  
 Dumas, Francis Kuper.... 23, Fenchurch Street, E.C.  
 Dumbrell, James, jun.... Ditchling, Sussex  
 Duncan, W. G.... Bradwell House, Stony Stratford  
 †Duncombe, Hon. O., M.P.... Waresley, Biggleswade  
 Duncombe, Hon. W. E., M.P.... The Leases, Bedale  
 †Duncombe, Sir P. P., Bart.... Blethley, Bucks  
 †Dun, Finlay.... Weston Park, Shipston-on-Stour  
 Dunford, Thos.... Tyne Iron Office, Newc-on-Tyne  
 †Dunn, Gen., R.E.... Denford House, Hungerford  
 †Dunn, Thomas.... 1, York Gate, Regent's Pk., N.W.  
 †Dunn, Wm. H.... Inglewood, Hungerford  
 Dunn, Mrs.... Newcastle-on-Tyne  
 †Dunne, Thomas.... Bircher, Leominster  
 Duncticliiff, W.... Frowell, Nottingham  
 Duplessis, Jules.... Newtown Park, Lymington  
 Duppa, T. D.... Longville, Shrewsbury  
 Du Pré, C. G., M.P.... Wilton Park, Beaconsfield  
 Dupuis, Rev. G. J.... Eton College, Windsor  
 Durant, Richard.... Sharpam, Devon  
 Durham, Makin.... Thorne, Yorkshire  
 †Duval, Fernand R.... Château de Marolles, France  
 Dyer, George.... Wey House, Alton  
 Dyer, John.... Hook Grange, Titchfield  
 Dyke, Sir P. H., Bart.... Lullington Castle, Dartford  
 †Dyke, Rev. T. H.... Long Newton, Stockton-on-Tees  
 Dyne, F. B.... University Club, Suffolk Street, S.W.  
 Dyott, Col.... Freeford Manor, Lichfield  
 Dyson, John.... 24, Dock Street, Leeds

## E.

Ealand, John Robert.... Aisthorpe, Lincoln  
 Eardley, Wm.... Larkton Hall, Malpas  
 †Earle, Frederic W.... Edenhurst, Prescott, Lancash.  
 Easam, William.... Averham Park, Southwell  
 East, Sir Gilbert W., Bart.... Hall Pl., Maidenhead  
 †Eathorpe, Sir John, Bart.... Fir Grove, Weybridge  
 Easton, George.... Horsley Hill, South Shields  
 †Easton, James.... Nest House, Gateshead  
 Easton, James.... Grove, Southwark, S.E.  
 Easton, William.... 6, Hammet Street, Taunton  
 Eastwood, R.... Thorney Holme, Whitewell, Clitheroe  
 Eaton, Charles O.... Tixover Hall, Stamford  
 †Eaton, George.... Spixworth, Norwich  
 Eckley, Richard.... 12, Darlington Place, Bath  
 †Eddison, Edwin.... Headingley Hill, Leeds  
 †Eddison, Francis.... Adel Mill, Leeds  
 †Eddison, R. W.... Headingley Hill, Leeds  
 †Eddison, William.... Huddersfield

†Eddowes, Thos. Henry.... Pontesbury, Salop  
 †Eden, Hon. Wm. Geo.... Doncaster  
 †Eden, J.... Beamish Pk., Chester-le-Street, Durham  
 Edge, Davis.... Outhill, Studley, Warwickshire  
 †Edge, James Thomas.... Strelley Hall, Nottingham  
 †Edmonds, F. Ezek.... Berryfield Ho., Bradford, Wilts  
 Edmonds, R.... West Buckland, South Molton  
 Edmondson, John.... Grassyard Hall, Lancaster  
 Edmunds, Edmund.... Rugby  
 Edwardes, Frederick.... Pilbroath, Carmarthen  
 Edwards, Francis.... Pickeridge House, Slough  
 Edwards, Frederick.... Barnham, Thetford  
 Edwards, Henry N.... Broadwood, Leominster  
 Edwards, James L.... Rochester, Kent  
 Edwards, John James.... Broad Heath, Presteign  
 Edwards, Joseph.... Hutton, Weston-super-Mare  
 Edwards, Joseph Priestley.... Fixby Park, Halifax  
 Edwards, Peter Norman.... Brinsop Court, Hereford  
 †Edwards, Thomas.... Wintercott, Leominster  
 Edwards, William.... Crewe Arms, Crewe  
 Effingham, Earl of.... Tusmore House, Bicester, Oxon  
 Egerton, Sir P. de M. G., Bt. M.P.... Tarporey  
 Egerton, Lord.... Tatton Park, Knutsford  
 Eggar, James.... Brinsted, Alton  
 Egginton, S. H.... North Ferriby, Brough, Yorkshire  
 Eichholtz, R.... Newcastle-on-Tyne  
 Ekin, Thomas.... Newmarket  
 †Eland, S. E.... Manor Ho., Stanwick, Higham Ferrers  
 Elcho, Lord, M.P.... Armisfield, Haddington, N. B.  
 Eley, Charles.... Beavers Farm, Hounslow, W.  
 Eley, W. H., jun.... Islington, Frindsbury, Rochester  
 †Elkins, J. N.... Elkington, Welford, Northamptonsh.  
 †Elliot, John.... Chapel Brampton, Northampton  
 †Elliot, John Lettsom.... 48, Grosvenor Street, W.  
 Elliott, John.... Moor Hall Courts, Newc-on-Tyne  
 Elliott, John.... Newcastle-on-Tyne  
 Ellis, Charles.... Franklands, Hurstpierpoint  
 Ellis, Charles.... Meldreth, Royston, Cambridge  
 Ellis, Job.... Oswestry  
 †Ellis, John.... Artington, Guildford  
 Ellis, I. P.... The Field, Hampton Bishop, Hereford  
 †Ellis, Robert Ridge.... Yalding, Kent  
 Ellison, Charles.... Oldbury Lodge, Bridgnorth  
 Ellison, Francis Charles.... Low Sizergh, Milnthorpe  
 Ellison, P. G.... Royal Arcade, Newcastle-on-Tyne  
 Elliston, B. A.... Croydton Arrington, Cambridge  
 Ellman, R. H.... Landport, Lewes  
 Ellman, Thomas.... Beddingham, Lewes  
 Elmhirst, Rev. E.... Shawell Rectory, Rugby  
 †Elmsall, Mansfeldt de C.... The Club, York  
 Elorza, General da Francisco.... Tubia, Oviedo  
 †Elston, Capt. W.... St. Ann's Rd., North Brixton, S.  
 Elton, Sir E. M., Bt.... Widworthy Court, Honiton  
 Elton, Major Robert James.... Whitestanton, Chard  
 Elvidge, Benjamin.... Leven, Beverley  
 Elwes, John H.... Closeburn House, Cheltenham  
 Embleton, Dennis, M.D.... Newcastle-on-Tyne  
 Embleton, Robert.... Backworth, Newcastle-on-Tyne  
 Emery, E. Crosswiller.... Storrington, Sussex  
 Emery, R. Coleman.... Hurston Pl., Storrington, Sus.  
 Emson, H. H.... Nether Hall, Cherry Hinton, Camb.  
 †Enfield, Viscount.... Wrotham Park, Barnet, N.  
 England, Richard.... Binham, Wells, Norfolk

Enniskillen, Earl of... Florence Court, Ireland  
 †Entwistle, John S... Foxholes, Rochdale  
 Enys, John Samuel... Enys, Penryn, Cornwall  
 Evans, W. M... Langton Wragby, Lincolnshire  
 Erichsen, H. G... Newcastle-on-Tyne  
 †Erkoig, Adolphus... Derekegyhaza, Pesth, Hungary  
 †Erle, Rev. Christopher... Hardwicke, Aylesbury  
 Erle, Rt. Hon. Sir W., Kt... Bramshot Grange, Liphook  
 Ernest, Henry... 4, Whitehall, S.W.  
 Errington, George... 10, Rutland Square, Dublin  
 †Errington, Rowland... Sandon, Hexham  
 Esam, Wm... Averham Park, Southwell  
 Esdaile, W. C. D... Burley Park, Ringwood, Hants  
 †Estcourt, E. D. B... Newton House, Tetbury  
 Ethelstone, Rev. C. W... Up Lyme, Lyme Regis  
 Ethrick, Anthony... North Hylton, Sunderland  
 Evans, E. M... Llynbarried, Nantmel, Kington  
 Evans, Edward... Boveney Court, Windsor  
 †Evans, E. Bickerton... Whitbourne Hall, Worcester  
 Evans, Edward... 7, Morton Street, Sunderland  
 Evans, George... Wimborne, Dorset  
 †Evans, Henry J... Bank, Cardiff  
 Evans, H. Rawlings, jun... Dilwyn, Leominster  
 Evans, Isaac Pearson... Griff, Nuneaton  
 Evans, James Eaton... Haverfordwest  
 Evans, John... Uffington, Salop  
 Evans, Robert... Tolladine, Worcester  
 Evans, R. P... Orpines, Watlington, Maidstone  
 †Evans, R. W... Eyton Hall, Leominster  
 Evans, Samuel... Daryl Abbey, Derby  
 Evans, Thomas... Astwood, Worcester  
 Evans, Thos. M... West Hill, Wandsworth, S.W.  
 Evans, Capt. T. B... Uddens, Wimborne, Dorset  
 Evans, Thomas Sutton... Saws'on, Cambridge  
 †Evans, Rev. W. E... Burton Court, Herefordshire  
 Everett, Rev. C. H... Netherton Ho., Hungerford  
 Everett, Frederick... Shaw Rectory, Newbury, Berks  
 Everington, William... Skegness, Boston  
 †Everington, Wm. D... Plumstead House, Norwich  
 Everitt, James... North Creak, Fakenham  
 Evershed, Henry... Park Hall, Gosfield, Halstead  
 Evershed, John... Albury, Guildford  
 Ewen, Thomas L'Estrange... Dedham, Colchester  
 Ewings, Wm... Lond. & Westm. Bank, Lothbury, E.C.  
 Exall, W... Kates Grove Works, Reading, Berks  
 Exley, Wm. H... Wisbeach  
 Eyke, John... Stanton, Shifnal  
 †Eyre, Edwin... The Cottage, Bishop's Stortford  
 †Eyre, G. E... Warrens, Stoney Cross, Southampton  
 Eyre, Henry R... Shaw House, Newbury  
 Eyre, Martin... 17, Bellevue Terrace, Hull  
 Eyre, R. T... Bartley, Totton, Southampton  
 †Eyles, Capt. Harry... Knockwood Park, Tenterden  
 Eyton, John Wynne... Lee's Wood, Mold  
 †Eyton, Thos. C... Vineyard, Wellington, Salop

F.

Faber, C. Wilson... Northaw House, Barnet, N.  
 Fail, Thomas... Blue House, Nedderton, Morpeth  
 Fair, J... Warton Lodge, Lytham, Preston, Lancs.

Fair, Jacob Wilson... Lymm, Warrington  
 †Fair, William... Aston-by-Budworth, Northwich  
 Fairbairn, George... Holmes Chapel, Cheshire  
 Faithful, Rev. G. D... Lower Heyford, Oxford  
 Falla, W. C... Crammer Dyke House, Gateshead  
 Falmouth, Viscount... Mereworth Castle, Maidstone  
 Fane, Cecil...  
 †Fardon, H. F... The Firs, Bromsgrove  
 †Farhall, J. N... Tillington, Petworth  
 Farley, Rev. C. Turner... Moorhall, Stourport  
 Farley, Stephen L... Heaton Dene, Newc.-on-Tyne  
 †Farmer, Archibald H... Theale, Reading  
 Farmer, Edward... Comberford Hall, Tamworth  
 Farmer, James... Stretford Bury, Leominster  
 Farnham, E. B... Quornodon House, Loughborough  
 Farnworth, J. K... Alderley Edge, Manchester  
 Farnworth, Thos. M... Alderley Edge, Manchester  
 †Farr, Richard... Wormesley Grange, Herefordshire  
 †Farr, Wm. Wyndham... Mord, Christchurch, Hants  
 †Farrell, Edward W... 3, Merrion Sq. East, Dublin  
 †Farrer, Edmund... Spole, Swaffham  
 Farrer, James... Ingleborough, Settle  
 †Farrer, O. W... 1, Hamilton Place, Piccadilly, W.  
 Farthing, Walter... Stowey Court, Bridgwater  
 Faulkner, C. F. A... Bury Barnes, Burford, Oxon  
 Faulkner, John... Bretby Farm, Burton-on-Trent  
 Faviel, George... Amcotes Lodge, Goole  
 Faviell, J. Brown... Stockeld Park, Wetherby  
 †Faviell, Mark, jun...  
 Faviell, William Fred... Down Place, Guildford  
 Fawcett, E. A... Childwick Hall, St. Albans  
 Fawcett, John... Durham  
 Fawcett, Theodore...  
 Fawcus, John... South Charlton, Chathill  
 Fawcus, Henry William... Elford, Chathill  
 Fawkes, F. H... Farnley Hall, Otley  
 Featherstone, Wm... Sunley Hall, Kirby-Moorside  
 Featherstonhaugh, R... Rockview, Killucan  
 Feilden, Captain H. M... Bank Hall, Clitheroe  
 Feilden, Captain J... Witton Park, Blackburn  
 Feetham, John... Great Burdon, Darlington  
 Felgate, W... 9, Westbourne Crescent, W.  
 †Fellowes, Jas... 29, Gloucester Place, W.  
 Fellowes, Robert... Bitteswell Hall, Lutterworth  
 Fellowes, Rev. T. I... Beighton Rectory, Acle  
 Fellows, W. Manning... Ormesby, Great Yarmouth  
 †Felton, Clement... Dunton, Fakenham  
 Fenton, John T... Waterloo Colliery, Leeds  
 †Fenton, Joseph... Bamford Hall, Rochdale  
 †Fenton, William... Beaumonts, Rochdale  
 Fenwick, George A... The Bank, Newc.-on-Tyne  
 Fenwick, George... North Shields  
 †Fenwick, Henry, M.P... Southill, Chester-le-Street  
 Fenwick, J. C... Riding Mill, Northumberland  
 †Ferard, Charles Colton... Ascot Place, Windsor  
 Ferrabee, Jas... Phoenix Ironworks, Stroud, Gloucester.  
 †Ferris, T... Manningsford Bohune, Pewsey, Wilts  
 †Ferris, William... Draycot, Marlborough  
 Festing, R. G... 1, Queen Sq. Place, Westminster, S.W.  
 Ffooks, Thomas... Sherborne  
 †Ffoulkes, Major John J... Llandysil, Shrewsbury  
 Fiddes, Thomas F... Towneley Lodge, Burnley  
 Field, George... Ashurst Park, Kent



†Field, Henry... East Lodge, Tulse Hill, S.  
 Field, James Pope...  
 Field, Samuel... Farnsfield, Southwell  
 †Field, William... 224, Oxford Street, W.  
 Field, William David... Swan Hill, Shrewsbury  
 †Fielden, Joshua... Stansfield Hall, Todmorden  
 †Fielden, S... Centre Vale, Todmorden  
 Fieldsend, C. R., jun... Kirmond, Market Rasen  
 †Filmer, Sir E., Bt., M.P... East Sutton Pk., Staplehurst.  
 Finch, J... 1, Adelaide Place, London Bridge, E.C.  
 †Finch, Rev. W... Warboys, Huntingdonshire  
 †Findlay, John... Garnstone, Hereford  
 Findlay, T. Dunlop... Easter Hill, Glasgow  
 Finlay, Alex. S... Castle Toward, Greenock  
 Finney, Samuel... Gateshead  
 †Finnis, Steriker... The Elms, Hougham, Dover  
 Firkins, Geo. John... Bishampton, Pershore  
 Firth, Samuel... Burley Wood, Leeds  
 Firth, William... Burley Wood, Leeds  
 Fisher, A. B... Poulshot, Devizes  
 Fisher, C... Prospect Ho., Distington, Whitehaven  
 Fisher, Henry... Michaelchurch, Ross  
 Fisher, James... Adelaide  
 Fisher, John... Carrhead Farm, Cross Hills, Leeds  
 Fisher, P... Prospect Ho., Distington, Whitehaven  
 Fisher, T. Forest... Ince Blundell, Liverpool  
 Fison, Cornell... Manor House, Feversham, Cambs.  
 †Fison, John Potterton... Horningsea, Cambs.  
 †Fitzgerald, Maj. H. T. G... Maperton Ho., Wincanton  
 Fitzgerald, Wm. Seymour... Hollbrook, Horsham  
 Fitzherbert, Sir W., Bt... Somersal Herbert, Uttoxeter  
 †Fitzhugh, Thomas Lloyd... Plas Power, Wrexham  
 Fitzhugh, Rev. Wm... Street, Lewes  
 Fitzpatrick, Rt. Hon. J. W... Abbeyleix, Ireland  
 Fitzroy, Lt. Col. H... Stratton Strawless, Norwich  
 Fitzroy, George... Grafton-Regis, Stony Stratford  
 †Fitzwilliam, Hon. C. W... Alwalton, Peterborough  
 Fitzwilliams, E. C. L... Belmont, Tenby  
 †Fitzygram, Fred., Lieut.-Col... Carlton Club, S.W.  
 Fleming, John... Newcastle-on-Tyne  
 †Fletcher, Lt.-Col. E. C... Kenward, Yalding  
 Fletcher, George... Shipton, Cheltenham  
 Fletcher, John Charles... Dale Park, Arundel  
 Fletcher, John Lynch... R.A. College, Cirencester  
 Fletcher, John... Sandway Lodge, Northwich  
 Fletcher, John... Merton, S.  
 †Fletcher, J. P... Sunbury, S.W.  
 †Fletcher, Capt. Joseph... Whitehaven, Cumberland  
 Fletcher, Robert... Hanover Square, Newc.-on-Tyne  
 Fletcher, Thomas... Deeping St. Nicholas, Spalding  
 Fletcher, William... Radmanthwait, Mansfield  
 Flower, Charles Henry... France Farm, Blandford  
 Flower, G. F. A... Stafford Farm, Dorchester  
 Floyer, John... Hints, Tamworth  
 †Floyer, John... Stafford, Dorchester  
 Floyer, John Wadham... Martin, Horncastle  
 †Foljambe, Geo. Saville... Osberton House, Workson  
 Folkstone, Viscount... Longford Castle, Salisbury  
 Fookes, H... Whitechurch Farm, Blandford  
 Forbes, John M... Dropmore, Maidenhead  
 Forbes, Sir John Stuart, Bart... Fettercairn, N.B.  
 Ford, Rev. C. H... Bishpton, Stockton-on-Tees  
 Ford, Elias... Abbotskerswell, Newton Abbott

†Ford, George... Barlaston, Stone, Staffs.  
 Ford, J., jun... Rushton Farm, Blandford  
 Ford, John... Morton Hall, Warwick  
 Ford, John... Market Rasen  
 Ford, William... Brinsop, Herefordshire  
 Fordham, Edward... Odsey House, Royston  
 Fordham, Edward King... Ashwell, Baldock  
 Foreman, George... Benton Grange, Newc.-on-Tyne  
 Forester, G. T... Ercall Magna, Wellington, Shrops.  
 Forester, Rev. R. T... Elmsley Lodge, Leamington  
 Forrest, Thomas... Spurston Hall, Tarporley  
 Forrester, George... Tombland, Norwich  
 †Forrester, Jos. James...  
 Forster, Abraham T... Garretstown, Kinsale  
 †Forster Charles... Hanch Hall, Lichfield  
 Forster, Edward... Salisbury Hall, Chingford  
 Forster, George... Washington, Durham  
 Forster, Richard... White House, Gateshead  
 Forster, R. C... White House, Gateshead  
 Forster, Robert... Tottenham Green, N.  
 †Forster, Samuel... Southend, Sydenham, S.E.  
 Forster, W... Herrington-hill Ho., Fence Houses  
 Fort, George... Alderbury House, Salisbury  
 Fortescue, Hon. G... Boconnock, Lostwithiel, Cornw.  
 Foster, J... Ledsham, Milford Junction  
 Foster, J. P... Killhow, Wigton, Cumberland  
 †Foster, John James... Mansion Street, Lincoln  
 †Foster, Richard... Castle, Lostwithiel, Cornwall  
 Foster, Richard... Gloucester  
 Foster, T. Nelson... Gloucester  
 Foster, Wm... Canwick House, Lincoln  
 †Foster, William... Stourton Court, Stourbridge  
 †Foster, W. O., M.P... Stourton Castle, Stourbridge  
 Fothergill, James... Beeston, Nottingham  
 Fothergill, Matthew... Cefnryhydhir, Newport, Mon.  
 Fothergill, R... Hensol Castle, Cowbridge, S. Wales  
 †Fountaine, Bernard T... Stoke House, Bleckley  
 Fowle, W... Market Lavington, Wiltshire  
 Fowler, Charles... Whitelands, Bicester  
 Fowler, John K., jun... Aylesbury  
 Fowler, M... Little Bushy Farm, Watford  
 †Fowler, Robert C... Gunton Hall, Lowestoft  
 Fowler, R., jun... 14, Bennett's Hill, Birmingham  
 Fowler, Edward Parsons... Jersey  
 Fowler, Francis... Henlow, Biggleswade  
 Fowler, L... Little Bushey Farm, Watford, Herts.  
 Fowlie, Wm...  
 Fox, Alfred Lloyd... Manure Works, Penrhyn  
 †Fox, Chas. B... Malpas, Newport, Monmouthshire  
 Fox, Frederick F... Melbourne, Derby  
 †Fox, G. Lane... Bramham Park, Tadcaster  
 Fox, Robert... Falconhurst, Cowden, Kent  
 Fox, W... Elfordleigh, Plympton St. Mary, Devon  
 Fox, William... Dunston, Sleaford  
 Frampton, Henry... Okers Wood, Dorchester  
 Francis, Clement... Quay Hall, Cambridgeshire  
 Francis, Frederick... Warley Place, Brentwood  
 Francis, S. R. G... Cranham Place, Romford, E.  
 Franklin, Edward L... Ascott, Wallingford  
 Franklin, John... Ewelme, Wallingford  
 †Franklin, Richard... Clemenstone, Bridgend  
 Franklin, Robert... The Park, Thaxted  
 Franks, George... Thong, Gravesend



Franks, James...Bramley, Guildford  
 Franks, Thomas...Westfield, Mountrath, Ireland  
 Fraser, Hugh...Culloden, Inverness  
 Frazer, Benjamin...High West Street, Gateshead  
 Frazer, Simon H...Elswick Villa, Newcastle-on-Tyne  
 Frazer, Wm...East Parade, Newcastle-on-Tyne  
 Frederick, Sir R., Bt...Burwood Pk., Walton-on-Th.  
 †Freebody, Wm. Y...239, Hackney Road, N.E.  
 Freeman, John Gardner...Rockfield, Hereford  
 Freeman, Joshua...Ashford, Staines  
 Freeman, P...High Heaton, Newcastle-on-Tyne  
 Freeman, P. jun...High Heaton, Newc.-on-Tyne  
 Freeman, Thos...Henham, Wangford  
 Freeman, Thomas...Benton Pl., Newcastle-on-Tyne  
 †Freeman, Thomas...27, Milbank St., S.W.  
 Freeman, W. P. W...  
 French, Richard Day...St. John's, Bungay  
 †Frere, G. E...  
 Frere, P. H...Regent Street, Cambridge  
 †Fries, Count August...Moravia  
 Frossard, Charles...Newcastle-on-Tyne  
 †Frost, Chas...Wherstead, Ipswich  
 Frost, Edward...West Watting Hall, Linton  
 †Fry, James Thomas...Boston, Bromley, S.E.  
 Fry, Thomas...Baglake Farm, Dorchester, Dorset  
 Fryar, Mark...Aighton Lodge, Gateshead  
 †Fryer, H. C...Lodge Park, Taliesin, Shrewsbury  
 Fryer, W. Fleming...The Wergs, Wolverhampton  
 †Fryer, W. R...South Lytchett House, Poole  
 Fuggle, T. G...Worcester  
 Fulcher, Thomas...Elmhurst Hall, Thetford  
 Fuller, F. G...Reading  
 Fuller, Robert Willes...Croydon, S.  
 Fulljames, Thos...84, Burton Street, Gloucester  
 Fulshaw, Richard...Bushby House, Leicester  
 Furness, John...Coxhoe, Ferryhill, Durham  
 Furniss, Laur...Birchill Farm, Baslow, Chesterfield  
 Fussell, Rev. James G. C...The Chantry, Frome  
 †Fytche, J. Lewis...Thorpe Hall, Elkington, Louth

G.

Gadesden, Augustus W...Leigh House, Tooting, S.  
 Gaisford, Major T...Baystone, Chipping Sodbury  
 Gale, Chas. J...Kilnocks, Botley, Hants  
 Galpin, George...Kingston Farm, Dorchester  
 Galpin, John...Dorchester  
 †Galpin, Thomas P...Little Langford, Heytesbury  
 Galton, Darwin...Claverdon Leys, Warwick  
 †Galway, Viscount, M.P...Serlby Hall, Bawtry  
 †Gamble, D...Gerard's Bridge, St. Helen's, Lanc.  
 Gamble, Thomas...Canwick Road, Lincoln  
 Gambles, Herbert E...Nocton, Lincoln  
 Gamgee, Prof. J...New Veterinary Col., Edinburgh  
 †Gamlen, Wm. H...Hayne House, Tiverton  
 †Gammie, Geo...Shotover House, Wheatley, Oxon  
 Gamon, W...The Green, Thornton-le-Moor, Chester  
 Gandy, Rev. J. H...Stanwick, Higham Ferrers  
 Gandy, Lt.-Col...Heaves, Milnthorpe  
 Gape, G. Thos...Elm House, Winkfield, Windsor  
 Garbatt, Thomas...Yarm, Cleveland  
 Garbutt, Cornelius...Dunston Lodge, Gateshead  
 Garbutt, Cornelius Durham...Gateshead

Garbutt, William...Dunston Lodge, Gateshead  
 †Gard, R. Sommers...Rougemont House, Exeter  
 Garde, T...Ballinacurra, Midleton, co. Cork  
 Gardner, Francis...Ryburgh, Fakenham  
 Gardner, R. W...Parsonage, Ombersley, Droitwich  
 Gardner, Thos. K...Leighton, Wellington, Salop  
 Gardner, W. A...Hough Green, Chester  
 Gardner, William Nettleton...Wells, Norfolk  
 †Gardom, T. W...The Yild, Baslow, Chesterfield  
 Garlit, Charles...Wincham Cottage, Knutsford  
 Garmon, John...Worcester  
 Garne, George...Churchill Heath, Chipping Norton  
 †Garne, John...Fifkens, Lechlade  
 †Garne, Robert...Aldsworth, Northleach  
 †Garne, Wm...Kilkenny Farm, Bibury, Fairford  
 Garnett, Jeremiah...Wharfeside, Otley, York  
 Garnett, William...Clitheroe  
 Garnett, W. J., M.P...Bleasdale Tower, Garstang  
 Garrard, E. H...Clopton House, Broadway, Worc.  
 Garrard, C. B. D...Lamar Hall, St. Albans  
 †Garratt, John...Bishop's Court, Exeter  
 Garraway, E...Norcott Farm, Womersley, Guildford  
 Garrett, Richard...Carlton Hall, Saxmundham  
 Garrod, R. H...Kilforge, Ross  
 Garsed, John...The Moorlands, Cowbridge  
 Garth, T. C...Haines Hill, Reading  
 Gascoyne, Wm...Bapchild Court, Sittingbourne  
 Gascoyne, William Whitehead...Sittingbourne  
 †Gaskell, Henry L...Kiddington Hall, Woodstock  
 †Gatacre, Edward L...Coton, Kidderminster  
 Gater, John...West End, Southampton  
 Gates, R...7, Sussex Place, Horsham  
 Gatty, George...Felbridge, East Grinstead  
 Gaudern, J...Earl's Barton, Wellingborough  
 Gaunt, Thomas...Smite, Worcester  
 Gauntlett, F. E...Leazes Terrace, Newcastle-on-Tyne  
 Gauntlett, W. H...Eston Junct., Middlesbro'-on-Tees  
 †Gauthorp, Henry...Widness, Warrington  
 †Gawne, Edw. Moore...Kentraugh, Isle of Man  
 †Geary, Sir W. R. P., Bt...Oxen Heath, Tunbridge  
 Gee, Thomas...Brothertoft, Boston  
 Geldard, Chris. John...Cappleside, Settle  
 Gelderd, George A...Aikrig End, Kendal  
 Gell, Robert...Grimston Lodge, York  
 George, Thomas...Bythorne, Thrapstone  
 George, T. Willington...Bellevue House, Leeds  
 †German, George...Measham Lodge, Atherstone  
 Gervis, Sir G. E. M. T., Bt...Christchurch, Hants  
 Gibb, James...Crown Villa, Southport  
 Gibbon, A...Staunton, Coleford, Gloucestershire  
 Gibbens, Edward...Minster, Isle of Thanet  
 Gibbons, Henry...Hampton Bishop, Hereford  
 Gibbons, Stephen...Brocklesby Park, Ulceby  
 †Gibbs, George...Belmont, Bristol  
 †Gibbs, Hen. H...St. Dunstan's, Regent's Pk., N.W.  
 Gibbs, Philip H...Eckington, Worcester  
 Gibbs, Robert...Carhampton, Dunster  
 Giobs, Thomas...Sawndby, Retford  
 Gibbs, Thomas...26, Down Street, Piccadilly, W.  
 Gibbs, W...Alveston Hill, Stratford-upon-Avon  
 Gibbs, Wm...Tyntesfield, Bourton, Bristol  
 Giblett, John...Lower Clapton, N.E.

†Gibson, John Kirk...Ingleby, Lincoln  
 Gibson, Robt...South Benwell, Newcastle-on-Tyne  
 Gilbert, Henry...Barnby Manor, Newark, Notts  
 Gilbert, James...117, Wheeler's Road, Birmingham  
 †Gilbert, R....Ashby Hall, Berghapton, Norfolk  
 †Gilbert, R., jun....Ashby Hall, Bergh Apton, Norfolk  
 †Gilbert, Thomas W....The Close, Salisbury  
 †Gilbert, William A....Cantley, Acle  
 Gilbertson, M....Elm Cottage, Egham Hill, Surrey  
 Giles, Henry, jun....Croxtan Park, Thetford  
 Gilford, William...North Luffenham, Uppingham  
 Gill, George...Weston, Shrewsbury  
 Gillespie, A...12, St. Mary's Terrace, Newc.-on-Tyne  
 Gillett, Charles...Cote House, Bampton, Oxon  
 Gillett, John...Fawler, Charlbury  
 Gillett, John...Minster Lovel, Witney  
 Gillett, Thomas...Kilkenny, Faringdon  
 Gilrow, Rev. Charles...Ushaw College, Durham  
 Gilliat, W. J...Ashby Puerorum, Horncastle, Lincs.  
 Gilpin, James...Roseworth Villa, Newcastle-on-Tyne  
 Gilpin-Brown, G...Sodbury Park, Richmond, Yorks.  
 Gilstrap, G....Winthorpe House, Newark-on-Trent  
 Gilstrap, William...Fornham Pk., Bury St. Edmunds  
 Ginders, Samuel...Ingestre, Stafford  
 Giraud, Edward...Preston, Wingham  
 Glanville, R. Carew...Eccles, Newtown, Colistream  
 Glaisier, William Richard...41, Charing Cross, S.W.  
 Glegg, J. B...Withington Hall, Chelford, Congleton  
 Glegg, Lt.-Col. E. Holt...Backford Hall, Chester  
 Glen, G....Stratton Audley Park, Bicester  
 †Glendining, Alexander...Red Leaf, Penhurst  
 Glenton, Frederick...Bensham, Newcastle-on-Tyne  
 Glover, John...Bangley, Tamworth  
 Glover, Robert...Wexford, Lichfield  
 Glynn, Rev. Henry...Hawarden Rectory, Chester  
 Glynn, Sir S., Bt., M.P...Hawarden Castle, Flintsh.  
 †Gobbitt, John...Wickham Market, Suffolk  
 Goddard, H. N...Manor Ho., Cliffe, Wootton-Basset  
 Goddard, Thomas...St. Fagans, Cardiff  
 Goddard, Wm. Gibert...Broad Chalk, Salisbury  
 †Goddard, William R....Somerset House, W.C.  
 †Godsal, Philip Wm...Iscoyd Pk., Whitchurch, Salop  
 Godwin, Robert...Water Eaton, Cricklade  
 Godwin, William...Lugwardine, Hereford  
 Goggs, James...Great Baddow Park, Chelmsford  
 †Goldhawk, R., jun...Hasle Hall, Steer, Guildford  
 Goldingham, H. G...Newland Court, Malvern  
 Goldsmith, Thomas...Dairy Farm, Ixworth  
 †Gonne, Charles...Warley Lodge, Brentwood  
 Gooch, John Kerr...East Tutenham, Norwich  
 †Gooch, John Virel...Reform Club, Pall Mall, S.W.  
 Gooch, Stephen...Honingham, Norwich  
 Good, Samuel C...Aston Court, Tenbury  
 Goodchild, Philip...Norfolk Farm, Windsor Park  
 †Goodden, John...Over Compton, Sherborne, Dorset  
 †Goodhart, Charles E...Langley, Beckenham  
 †Goodlake, F. Mills...Wadley Ho., Faringdon  
 Goodson, Wm...Hill Farm, Mitcham, S.  
 Goodwin, Frederick...Droitwich  
 Goodwin, G....Pershire Mills, Pershore, Worcs.  
 Goodwin, J....Bath and West of England Soc., Bath  
 Goodwin, Ralph Willis...Burnham Abbey, Maidenhead  
 Goody, Golden...Broom House, Chapel, Halstead

Gordon, Charles...Discombe Park, Honiton  
 Gordon, James...Park House, Gateshead  
 Gordon, R....Kemble House, Cirencester  
 Gorringe, Hugh...Southwick Green, Shoreham  
 Gosford, Vincent...Tan-y-llan, Holywell, Flintshire  
 Gosling, John...Brewery, Bocking, Essex  
 Gosling, Robt...Hassobury, Bishop's Stortford, Herts  
 Gosling, Thomas G...15, Portland Place, W.  
 †Gosset, Major Arthur...West Park, Mortlake, S.W.  
 †Goteh, Wm. Hepburn...Bratton, Weatbury  
 Goucher, John...Woodsetts, Worksop  
 Gough, Ashwin D...Hinton-on-the-Green, Evesham  
 Gough, Edward...Gravel Hill, Shrewsbury  
 Gould, John...Hyde Hall, Denton, Manchester  
 Gould, Joseph...Newhall, Broadclist, Devon  
 Gould, Rev. Joseph...Hurst Green  
 Gouldbourne, Joseph...Wilkesley, Whitchurch  
 Goulding, Wm...108, Patrick Street, Cork  
 Gouthwaite, Richard...Lumby, South Miford  
 †Gow, James...Fowler's Park, Hawkhurst, Kent  
 Gow, Thomas...Cambo, Newcastle-on-Tyne  
 †Gower, A. L...Castle Malgwyn, Newcastle Emlyn  
 Gower, Andrew...Market Drayton  
 †Gower, Erasmus...Clynderwen, Narberth, S.W.  
 †Gower, J. Leveson...Westwood, Colchester  
 †Gower, Robt. F...Clynderwen, Narberth, S.W.  
 †Gower, G. W. G. Leveson...Titsey Pk., Godstone  
 Gow, E. N...Newcastle-on-Tyne  
 Grace, Nathaniel...Broomfield, Newcastle  
 Grace, T. C...Broomfield, Newcastle-on-Tyne  
 Grace, William...Scotswood Villa, Newc.-on-Tyne  
 Grace, Wm...Park Road, Newcastle-on-Tyne  
 †Grafton, Duke of...Euston, Thetford  
 Graham, Alexander...Barnston, Birkenhead  
 †Graham, James...Beaulieu, Southampton  
 Graham, James...York Road, Leeds  
 Graham, Walter...West Drayton, Uxbridge  
 Graham, William, jun...Pewet, Abingdon  
 Graham, Wm., jun...Newport, Monmouth  
 Grain, Peter...Shelford, Cambridge  
 Grant, Effingham...Bucharest, Wallachia  
 †Grant, Sir G. McPherson, Bt...Ballindalloch Cas., N.B.  
 Grant, John...Wester Hill, Linton, Staplehurst  
 Grant, William...Litchborough, Weedon  
 †Grantham, George...Barcombe Place, Lewes  
 Grantham, Captain, H. V...Scawby, Brigg.  
 Grantham, Henry...Scawby, Brigg  
 Grantham, R. B., C.E., F.G.S., 7, Gt. Scotland-yd., S.W.  
 Grantham, Rev. Thos...Bramber, Steyning  
 †Granville, Earl...Aldenharn, Bridgnorth  
 Graves, A. E...Rosbercon Castle, New Ross, Wexford  
 Graves, Robert...Charlton, Shaftesbury  
 †Gray, G. W...5, St. Mary Abbot's Ter., Kens., S.W.  
 Gray, John C...King's Grange, Castle Douglas, N.B.  
 †Gray, Jonathan...Summerhill, Bath  
 Gray, Thomas...Newcastle-on-hyne  
 Grazebrook, George...The Race Course, Stourbridge  
 Greaves, William...Bakewell, Derbyshire  
 Green, A. Whyte...Cray House, Glensher, Blairgowrie  
 Green, E. W...Flint Ho., Holcombe, Stratton-on-Foss  
 Green, Rev. G. W...Court Henry, Dryslwyn, Carmar.  
 Green, John...Newtown Farm, Worcester  
 Green, Robert...Scalby, Scarborough

Green, Robert Yeoman... Newcastle-on-Tyne  
 Green, Rev. Thomas... Vicar of Badby, Daventry  
 †Greenall, G., M.P.... Walton Hall, Warrington, Lanc.  
 Greene, E.... West Gate, Bury St. Edmund's  
 †Greene, Harry A.... Crown Street, St. Ives, Hunts.  
 Greene, Michael... Bloomfield, Gateshead  
 Greene, John... Millbrook, Magary, Kildare  
 Greene, John... Rodsley House, Gateshead  
 †Greene, Thomas... Whittington Hall, Lancaster  
 Greene, Wm.... Ditcham Park, Petersfield  
 Greenwood, Charles... Wallingford, Berkshire  
 †Greenwood, J., M.P.... Swardcliffe Hall, Ripley, York  
 Greenwood, R.... Towse Ho., Ludford, Market Rasen  
 Greetham, Thomas... Stainfield Hall, Lincoln  
 Greetham, William... Stainfield Hall, Wragby  
 Gregg, James... Fencote Abbey, Leominster  
 †Gregg, Thomas...  
 †Gregor, Gordon W.F... Trewarthenick, Grampound  
 Gregory, George... Crowhurst, Battle  
 Gregory, J. S.... Harlaxton Manor, Grantham  
 Gregson, Brian Paget... Caton, Lancaster  
 †Gregson, Matthew... Toxteth Park, Liverpool  
 Gregson, T... New Bridge St., Newcastle-on-Tyne  
 Grenfell, Arthur Riversdale... Travellers' Club, S.W.  
 Grenfell, Chas. P., M.P.... 38, Belgrave Sq., S.W.  
 Grenfell, Riversdale W.... Ray Lodge, Maidenhead  
 †Grenville, Ralph N.... Butleigh Ct., Glastonbury  
 Gresswell, Dan.... Louth  
 Greville, Col. Fulke S.... North Mimms Park, Hatfield  
 †Grey, Rt. Hon. Sir G., Bt., M.P... Fallowdon, Alnwick  
 †Grey, Hon. Brow. N. Osborn De... Watton, Norfolk  
 †Grey, Adm. Hon. F. W... 13, New St., Sp. Gns., S.W.  
 †Grey, Hon. & Rev. F. De... Copdock Recty., Ipswich  
 †Grey, Hon. G. De... 11, South Audley Street, W.  
 †Grey, Charles G... Diston, Corbridge-on-Tyne  
 Grey, Jas... Kimmerston, Wooler, Northumberland  
 Grey, John... Lipwood House, Haydon Bridge  
 Griffin, Alfred E... Wolverhampton  
 Griffin, Clement W... Werrington, Peterborough  
 Griffin, Edward... Towersey, Thame  
 Griffin, John... Borough Fen, Market Deeping  
 Griffin, Fred. C... Methwold, Brandon, Norfolk  
 Griffith, C. Darby... Padworth House, Reading  
 Griffith, Edw. H... Plas-Newydd, Trefnant, Rhyl  
 Griffith, J... Llwyndurris, Newcastle-Emlyn  
 Griffith, John, jun... Trevorgan, Cardigan  
 Griffith, Samuel Y... Star Hotel, Oxford  
 Griffiths, Thomas J... Bishop's Castle, Salop  
 Griffiths, Edward... New Court, Hereford  
 Griffiths, John... The Weir, Hereford  
 †Grimes, Wm. Howlett... Bubenhall, Kenilworth  
 Grimston, Lt.-Col. Oswald A... Yeaton, Leamington  
 †Grissell, Thos... Norbury Park, Dorking  
 †Grisewood, H... Daylesford Ho., Chipping Norton  
 Grosvenor, Earl, M.P... 28, Princes Gate, S.W.  
 Grove, Philip... Eastcote, Towcester  
 Groves, John... 25, Oxford Street, Newcastle-on-Tyne  
 Grundy, E. S... Reddish Hall, Warrington  
 Gubbins, Joseph... Kilfrush, Knocklong, Limerick  
 Guerrier, W. G... 17, Crescent, Camden-rd. Villas, N.W.  
 Guilding, Richard... Malvern Wells  
 Gulliver, William... Swardcliffe, Banbury  
 Gulliver, Wm. H... Collingborne, Marlboro'

Gulston, Alan James... Woodland Castle, Swansea  
 Gun, R... Great Dalby Lodge, Melton Mowbray  
 Gunner, William... Will Hall, Alton  
 †Gunter, Captain Robert... Wetherby  
 †Gurdon, Brampton... Letton Hall, Shipdham, Norf.  
 †Gurdon, Rev. P... Cramworth Rectory, Shipdham  
 †Gurdon-Rebow, J... Wivenhoe Pk., Colchester  
 †Gurdon, William... Biantam, Manningtree  
 Gurney, Jason... Hounslow, W.  
 †Gurney, John Henry, M.P... Easton, Norwich  
 †Gurney, Russell... 8, Palace Gardens, Hyde Pk., W.  
 Gurney, Samuel, M.P... Carshalton, S.  
 Guthrie, James... Sedgwick Place, Gateshead  
 †Guthrie, John... Guthrie Castle, Forfarshire  
 Gwyn, H., M.P... Dyffryn, Neath, Glamorganshire  
 Gwyn, Rich. H... Astbury Hall, Bridgnorth, Salop  
 Gwyn, Wm. Edw... Plas Cwrt Hyrs, Carmarthen  
 Gyles, John... Aplayhead, East Retford, Notts

## H.

Haansbergen, W.I... Endfield Lodge, Newc.-on-Tyne  
 Hacker, John Heathcote... Leek, Staffordshire  
 Hadden, A... The Old Parks, Ashby-de-la-Zouch  
 Haddock, Henry... 6, Glo'ster Pl., Regent's Pk., N.W.  
 Hagen, Jacob... Ropley House, Alresford  
 Haggard, Wm. M. R... 30, Clarendon Sq., Leamington  
 Hagger, Franklin... Hertford  
 Haggie, Peter... Whaggs House, Whickham, Durham  
 †Haig, J. H... Highfields Park, Wythiam, Sussex  
 Haine, George... Over Farm, Gloucester  
 Haines, Edward... Moorwood House, Cirencester  
 Haines, J. Pool... Duntisbourne House, Cirencester  
 Hainworth, William... Hitchin  
 Hale, Chas. C... Glenlochay, Killrie, Perthshire  
 Hales, C... Manor House, Bassingbourne, Royston  
 Hales, Edward... North Frith, Tonbridge  
 Halewood, Edward... Great Crosby, Lancaster  
 Halford, Charles... Newbold Mill, Worcestershire  
 Halford, T... Glenfren, Newtown, Montgomerysh.  
 Halford, T... Newbold-on-Stour, Shipston-on-Stour  
 Hall, Alexander Hall... Watergate, Emsworth  
 Hall, Benjamin... Wood Farm, Malvern Wells  
 Hall, Charles... Down Lodge, Reigate  
 Hall, Collinson... Navestock, Romford, E.  
 Hall, Francis... Park Hall, Mansfield  
 Hall, George... Garford, Yarkhill, Ledbury  
 Hall, George... 1, Copland-terrace, Newc.-on-Tyne  
 †Hall, Henry...  
 Hall, Henry... Alton  
 Hall, James... Scarborough Hall, Beverley  
 †Hall, John... Hesley Hall, Tickhill, Rotherham  
 Hall, J.O... 1, Brunswick Row, Queen's Sq., W.C.  
 Hall, John... Sibthorpe, Newark-on-Trent  
 Hall, Major-Gen... Carlton Club, Pall Mall, S.W.  
 †Hall, Marshall... Blacklands Park, Calne, Wilts  
 Hall, Richard... Raglan House, Neath, Glamorgansh.  
 Hall, T... Duke's Oak, Brereton, Congleton  
 Hall, Thomas K... Holly Bush, Burton-on-Trent  
 Hall, T. Young... 11, Eldon Sq., Newcastle-on-Tyne  
 †Hall, William... Ashton, Leominster  
 Hall, Wm... Seven Springs, Cubberley, Cheltenham



- Hallam, John...Newcastle, Staffordshire  
Hallam, Thos....Bridlesmith Gate, Nottingham  
Hallett, Fred. Fran....The Manor House, Brighton  
†Halliday, J....Chapel Cleeve, Taunton  
Halliday, Thomas C....  
Hallowes, Thomas...Glasswell Hall, Chesterfield  
†Halls, Joseph...Denham Hall, Bury St. Edmund's  
Halse, J. C....Pulworthy, Molland, South Molton  
Halse, Philip...Molland, South Molton  
Halsey, Rev. J. F. Moore...Hemel Hempstead  
Halsey, Thomas...Compton House, Newent  
Halsted, Thomas...Woodcote, Chichester  
Halton, Rev. Emmanuel...Winfield Manor, Alfreton  
†Hambro, Charles...Milton Abbey, Blandford  
†Hambrough, Albert J....Steep Hill Castle, Ventnor  
Hammersley, Hugh...Great Haseley, Tetsworth  
†Hames John...Rotherby, Leicester  
†Hamilton, Capt. Archibald...Rozelle, Ayr  
Hamilton, Chas. W....Hamwood, Dunboyne, Ireland  
†Hamilton, John...Belmont, Ayr, N. B.  
†Hamilton, John...Hilston Park, Monmouth  
†Hamilton, Sir R. N. C., Bt., K.C.B....Park Steet, W.  
†Hamilton, Wm. M....2, Orchard Place, Canterbury  
Hammond, Dr...11, Charlotte St., Bedford Sq., W.C.  
Hammond, Horace John...Chapel Farm, Eltham  
Hamond, Charles Frederick...Newcastle-upon-Tyne  
Hamond, Philip...Ashurst Lodge, East Grinstead  
†Hamond, W. Parker...Pampisford Hall, Cambridge  
Hampton, George...Findon Park Farm, Worthing  
†Hanbury, E....Eastport House, Highworth  
Hanbury, Robert...Poles, Ware  
Hancock, Abraham...Little Grove, Ropley, Alresford  
Hancock, J. Donne...Halse, Taunton  
Hancock, T....Staplefield Common, Crawley, Sussex  
Hand, James...Ludlow  
†Handley, Maj. Benj....Folkingham, Lincolnshire  
Handy, Edward...Sierford, Cheltenham  
Hanmer, Col. H....Stockgrove, Leighton Buzzard  
Hanmer, Sir J., Bt., M.P....Bettisfield Pk., Whitechurch  
Hannam, Charles...Northbourne Court, Deal  
Hannam, Fenwick...Newcastle-on-Tyne  
Hannam, Henry J....Bucrote, Abingdon  
†Hannay, Robt....Springfield, Ulverston  
Hansell, Thomas...North Shields  
Hanson, T. A...162, Upper Brook St., Manchester  
Harbin, George...Newton House, Yeovil  
†Hannay, Robert...Springfield, Ulverston  
Harcourt, Colonel Francis V...5, Carlton Gns., S.W.  
†Hardacre, Richard...Hellifield, Leeds  
Harding, Egerton W....Old Springs, Market Drayton  
Harding, George...Durweston, Blandford  
†Harding, John...Dursley, Gloucestershire  
Harding, James...Waterson, Dorchester  
Harding, S. T....Stinsford Farm, Dorchester  
Harding, Wm. C....Thame  
Hardinge, Edm. S....Bounds Park, Tonbridge Wells  
Hardon, Edwin...Edgeley, Stockport  
Hardstaffe, Dodson...West Leak, Loughboro'  
Hardwick, Alfred...Hangleton, Shoreham  
Hardy, James...Jaques Hall, Manningtree  
†Hardy, John...Dunstall Hall, Burton-on-Trent  
Hardy, Peter...The Grange, Claines, Worcester  
Hardy, Richard...Marchington, Uttoxeter  
†Hardy, W. H. C....Letheringsett Hall, Holt, Norfolk  
Hardy, William Thistleton...Market Overton  
Hare, Joseph...Wilton Farm, Beaconsfield  
†Hare, Sir J., Bt....12, Pall Mall East, S.W.  
Hare, Sir Thos., Bt....Stow Hall, Downham Market  
Hare, Thomas W....Berthddu, Caesws, Montgomery  
†Harewood, Earl of...Harewood House, Leeds  
†Harford, J. B....Stoke House, Stoke Bishop, Bristol  
†Harford, John Scodrett...Blaize Castle, Bristol  
†Harford, W....Barley Wood, Wrington, Bristol  
Harker, James...Tibshelf, Alfreton  
Harker, Rev. Wm....Camberwell, S.  
Harkes, William...Lostock, Knutsford  
Harle, W. Lokey...Newcastle-on-Tyne  
†Harman, Hon. L. King...Ballymena, co. Longford  
†Harper, Latimer...Chilton Cottage, Hungerford  
Harrett, R....Kirkwhelpington, Newcastle-on-Tyne  
Harries, Francis, jun....Cruckton Hall, Shrewsbury  
Harriman, William...Blaydon-on-Tyne  
†Harris, Lord...Belmont, Faversham  
Harris, John...Sutton, Kegworth, Derby  
Harris, Richard...Wootton Grange, Northampton  
Harris, Thomas...Stonylane, Bromsgrove  
Harrison, G. P....Gembling, Lowthorpe, Hull  
Harrison, John...Summerlands, Kendal  
Harrison, J., jun....Snelston Hall, Ashbourne, Derbys.  
Harrison, J., jun....Heaton Norris, Stockport  
Harrison, J. F....Caterham Court, Redhill  
Harrison, J. T....Frocester Court, Stonehouse, Glouc.  
†Harrison, Richard...Wolverton, Stony Stratford  
Harrison, Rev. R.J....Caerliowell, Garthmyl, Shrewsb.  
Harrison, Rev. J. H....Bugbrooke Rectory, Weedon  
Harrison, Thomas...Belsay, Newcastle-on-Tyne  
Harrison, William H....Oxendon, Northamptonsh.  
Harrowby, Earl of...Norton Ho., Campden, Gloucesters.  
Hart, George...Wakefield  
Hart, Henry P....Beddingham, Lewes  
Hart, Thomas...Ascott, Leighton Buzzard  
†Harter, Rev. G. G....Cranfield, Newport Pagnell  
†Harter, Jas. Collier...Broughton Hall, Manchester  
Hartill, Jeremiah...Willenhall, Wolverhampton  
Hartley, Gilferd Wm....Rosehill, Whitehaven  
Harvey, Chas. W....Walton-on-the-Hill, Liverpool  
Harvey, Edw. N....Fawley, Southampton  
Harvey, John J....Statenboro' House, Sandwich  
†Harvey, Richard...Greenaway, Torquay  
Harvey, Richard Hart...Haroldston, Haverfordwest  
Harward, John...Chaddesley Corbet, Kidderminster  
Harwood, Thomas...Belstead Hall, Ipswich  
†Haslewood, Lewis Robert...33, Queen's Sq., W.C.  
Haslam, Charles...Basingstoke  
Haslar, Richard...Aldingbourne, Chichester  
†Hassall, Geo....Shelford Manor, Ratcliffe-on-Trent  
Hassall, Wm....Babney, Whitechurch, Salop  
Hatfield, Chas. Taddy...Hartsdown House, Margate  
Hatfield, Thomas...St. Martin's, Stamford  
Hatherton, Lord...Teddesley, Penkridge  
Hatton, William...Kingston, Tetsworth, Oxon  
Havelock, Michael...Newcastle-on-Tyne  
Havers, William...Bacon's Farm, Mountnessing  
Haward, R....Mells Hill, Halesworth  
Hawarden, Viscount...Dundrum Castle, Cashel  
Hawdon, William W....Walkerfield, Staindrop



Hawkesley, Archibald... Englefield Green, Surrey  
 †Hawkesworth, R. S... Forest, Mountrath, Queen's co.  
 Hawkins, H. M... Tredunnoch, Usk, Monmouthsh.  
 †Hawkins, T... Smallbridge, Bures St. Mary, Suffolk  
 †Hawkins, Thos., jun... Sugwas, Hereford  
 Hawning, James... Stubbings, Maidenhead, Berks  
 Hawks, George... Gateshead Iron Works, Gateshead  
 Hawthorn, Robert... Newcastle-on-Tyne  
 Hawthorn, W... Benwell Cottage, Newcastle-on-Tyne  
 Hawthorn, William... Benwell, Newcastle-on-Tyne  
 Hawxwell, Alfred... Thirsk  
 †Hay, C. Anderson... 17, York Ter., Rgt's Pk., N.W.  
 Hay, G. W... Sudbury, Derby  
 Hayes, Henry... Stamford  
 Haynes, John Higson... Frodsham  
 †Hayne, John... 24, Gloucester Sq., Hyde Park, W.  
 Hayne, Col. Richard...  
 Hayter, Tom John... West Woodgates, Salisbury  
 Hayward, H. S... Folkington, Willington, Sussex  
 Hayward, Chas... Dartmouth Grange, Dartmouth  
 Hayward, Frederick... Needham Market  
 Hayward, J. Curtis... Quedgeley House, Gloucester  
 Haywood, Edward W... Sillins, Bromsgrove  
 Haywood, George... Derby  
 Haywood, James, jun... Derby  
 Haywood, Henry... Blakemere House, Hereford  
 Hazlerigg, Sir A. Grey, Bt... Noseley Hall, Leicester  
 Head, John... Orwell Works, Ipswich  
 Head, John... Elswick Grange, Newcastle-on-Tyne  
 Head, William Alston... East Grinstead [nard Castle  
 †Headlam, Rt. Hon. E., M.P... Gilmonby Hall, Bar-  
 Headlam, Morley... Whorlton, Darlington  
 Headly, Edward... 2, New Square, Cambridge  
 †Heale, H. Newton... Highfield, Hemel Hempstead  
 Heale, Edward Charles... Goldwynds, Dorking  
 Heaps, Christopher... Leeds  
 Heard, Wm... St. Margaret's, Ware  
 Hearne... Stephen Street, Abbots Salford, Evesham  
 Heasman, Alfred... Angmering, Arundel  
 Heath, G. Y., M.D... Newcastle-on-Tyne  
 Heath, John... Bickley, Tenbury  
 Heath, R... Hefferstone, Weaversham, Northwich  
 Heath, Thomas... Little Benton, Northumberland  
 †Heathcote, Capt. Eustace... Blanshard, Lyndhurst  
 †Heathcote, J. M... Connington Cas., Stilton, Hunts.  
 Heathcote, Richard... Bayterby, Atherstone  
 Heatley, John... Eaton, Market Drayton  
 †Heatley, R. T... Dodicote Grange, Market Drayton  
 Heaton, Thomas... Alton, Cheadle, Staffordshire  
 Hedley, G... 50, Westmoreland Ter., Newcastle-on-T  
 Hedley, G... 3, Indian King's Court, Newcastle-on-T  
 Hedley, Thomas... Cox Lodge, Newcastle-on-Tyne  
 Hegan, Joseph... Liverpool  
 Hellier, Thos. Shaw... Rodbaston Hall, Penkridge  
 †Hellyer, G. W. M... India  
 Helps, Arthur... Vernon Hall, Bishop's Waltham  
 Helps, Richard... 1, Barton Street, Gloucester  
 Helyar, Wm. Hawker... 26, Manchester Sq., W.  
 Hemming, George... Pershore  
 Hemming, Richard... Bentley Manor, Bromsgrove  
 Hemming, Wm... Coldicott, Moreton-in-the-Marsh  
 †Hempson, John A... Erwarton Hall, Ipswich  
 †Hemsley, John... Shelton, Newark, Notts

Henderson, John... The Shrubbery, Sandwich  
 Henderson, George... Harton, South Shields  
 Henderson, John... Horsley Hill, South Shields  
 Henderson, W... Fowberry Maines, Belford  
 Henderson, William... Harton, South Shields  
 Hendy, James... Trenouth, Grampound  
 Heneage, Geo. H. Walker... Compton Basset, Calne  
 †Henley, Rt. Hon. J. W., M.P... Waterperry, Oxon  
 †Henning, James... 6, Upper Avenue Road, N.W.  
 Henning, William L... Frome House, Dorchester  
 Henry, Frederick H... Lodge Park, Straffan, Ireland  
 Henry, Capt. James... Blackdown House, Petworth  
 Henton, Samuel... 268, Westm. Bridge Road, S.  
 Hepburn Thomas... Clapham Common, S.  
 Heppell, John Todd... 3, Prior Terrace, Tynemouth  
 Hepworth, Joshua... Rogerthorpe, Pontefract  
 Herbert, Edmund... Powick, Worcester  
 †Herbert, John Maurice... Rocklands, Ross  
 Herbert, William... Kempsey, Worcester  
 Hervey, John... Cruchfield House, Maidenhead  
 Herrick, Wm. Perry... Beau Manor Park, Loughboro'  
 †Herries, Lord... Everingham Park, Pocklington  
 Hersee, Dennett... Wepham, Chichester  
 †Hertefeld, Baron de... Liebenberg, Berlin  
 †Heseltine, E... Blackheath Park, S.E.  
 Heseth, Sir T. G., Bt., M.P... Rufford Hall, Ormskirk  
 Heslop, Rev. Gordon... Cossall, Nottingham  
 Heslop, George... Fatfield House, Chester-le-Sireet  
 Heslop, Isaac... Urpeth, Chester-le-Street  
 †Hester, G. P... Town Clerk's Office, Oxford  
 Hetherington, Robt... Manor Ho., Ropley, Alresford  
 Hett, John... Gainford, Darlington  
 Hewer, John E., jun... Vern House, Hereford  
 Hewer, William... Hill Farm, Northleach  
 Hewer, Wm... Sevenhampton, Highworth, Wilts  
 Hewertson, Nelson... Newport, Monmouthshire  
 Hewitt, Jas... Posbroke, Titchfield  
 Hewitt, James... King James Street, Gateshead  
 Hewson, John Dale, M.D... Coton Hill, Stafford  
 Hext, Thomas... Trewarren, St. Austell  
 Heygate, Captain E. N... Buckland, Leominster  
 Heygate, Robert H. J... Docklow, Leominster  
 †Heytesbury, Lord... Heytesbury, Wilts  
 †Heywood, Sir Benj., Bt... Claremont, Manchester  
 †Heywood, J. M... 26, Palace Gardens, Kensington, W.  
 Heywood, Wm. H... Dunham Massey, Altrincham  
 †Hibbert, John... Braywick Lodge, Maidenhead  
 †Hibbert, P. E. T... Bilton Grange, Rugby  
 Hibbert, T. J... Broughton Grove, Newton-in-Cartm  
 †Hibbert, Washington... Bilton Grange, Rugby  
 Hickin, John... Bourton, Rugby  
 †Hicks, Francis... Halstead, Sevenoaks  
 Hicks, L... Paddock Lodge, Kentish Town, N.W.  
 †Hicks, Thomas... Halstead, Sevenoaks  
 Hickman, Capt. W. T... Woodlands, Havant  
 Hickson, Richard... Hougham, Grantham  
 Higginbotham, J... Pensax Court, Tenbury  
 Higginbotham, Samuel... Killermont, Glasgow  
 Higgins, H... Woolaston Grange, Lydney  
 Higgins, Thos... Lower Binton, Stratford-on-Avon  
 Higgins, Col. Wm. B. Cole... Pict's Hill, Bedford  
 †Higginson, Edmund... Saltmarsh, Bromyard  
 Hilder, John... Sandhurst, Kent

Hilder, William...Tenterden  
 Hill Trevor, Lord A. E....Norwood Park, Southwell  
 †Hill, T. Rowley...Catherine Hill House, Worcester  
 Hill, Hon. T. H. Noel...Berrington, Shrewsbury  
 Hill, Col. C. J....Cotgrave Place, Nottingham  
 Hill, Rev. J....The Citadel, Hawkstone, Shrewsbury  
 Hill, Henry...Thornton, Pickering  
 Hill, Henry...22, Queen's Gate Terrace, S.W.  
 Hill, Henry...Spalding  
 Hill, J....Elderslie House, London Road, Worcester  
 Hill, Rev. R. P....Bromesborough Rectory, Ledbury  
 Hill, Richard...Orleton Court, Ludlow  
 Hilliard, Geo. Bridge...Springfield, Chelmsford  
 Hilliard, William Edw....Cowley House, Uxbridge  
 Hilton, George...Flemings, Wickford, Essex  
 Hilton, Henry...Sole St. Ho., Selling, Faversham  
 Hilton, Stephen Musgrave...Brambling, Wingham  
 Hilton, Capt. Thos....Nackington Ho., Canterbury  
 Hincks, T. C....Brackenboro', Thirsk  
 †Hinde, J. H....Acton House, Felton, Northumb.  
 †Hippisley, John...Lamborne Place, Hungerford  
 †Hippwell, G. M....Cheam, S.  
 Hitch, Saml., M.D....Sandywell Park, Cheltenham  
 Hitchcock, H....Chitterne All Saints, Heytesbury  
 Hitchin, Thomas...Wardle Tile Works, Tarporley  
 Hitchings, Frederick...Havant, Hants  
 Hitchman, John, M.D....Mickleover, Derby  
 Hobbs, Charles...Maisey Hampton, Cricklade  
 Hobbs, William...Derward's Hall, Bocking, Essex  
 Hoblyn, W. Paget...Denzel Farm, St. Columb  
 Hobson, J....Kilkea, Castle Dermot, Kildare  
 Hobson, John George...Long Sutton  
 Hockenhall, John...The Flax Yards, Tarporley  
 Hockin, John...Bude, Cornwall  
 Hodge, G. W....George St. East, Newcastle-on-Tyne  
 Hodgkinson, Enoch...Morton Grange, Retford  
 Hodgkinson, Grosvenor, M.P....Winthorpe, Newark  
 Hodgkinson, Richard...Osberton Grange, Worksop  
 Hodgson, A...Drayton Hall, W. Drayton, Middlesex  
 †Hodgson, E. G....Charsfield Hall, Wickham Market  
 Hodgson, Isaac Scott...Sodylt Hall, Ruabon  
 Hodgson, J. . . . 3, Framlington Place, Newc.-on-Tyne  
 Hodgson, James...Liverpool  
 Hodgson, John...Newcastle-on-Tyne  
 Hodgson, John G....North Dene, Gateshead  
 Hodgson, Joseph...Blyth, Cumberland  
 Hodgson, R....Crofton Mills, Blyth, Northumberland  
 Hodgson, Richard...Chingford  
 Hodgson, R. W....North Dene, Gateshead  
 †Hodgson, William...Gilston Park, Herts  
 Hodgson, William...Grimston, Tadcaster  
 †Hoffschlaeger, J. F....Weisin, bei Mecklenburg  
 Hogg, G....46, Eldon Street, Newcastle-on-Tyne  
 Hogg, James...Buckton, Belford, Northumberland  
 Hogg, William...Mitford Steads, Morpeth  
 Hogge, William...Thornham Hall, Lynn  
 Hoggins, Thomas...Trafford Lodge, Chester  
 †Holbech, Rev. Chas. Wm....Farnborough, Banbury  
 Holben, R. Rowley...Barton, Cambridge  
 Holborow, Daniel...Knockdown, Tetbury  
 Holbrooke, George...Athenborough, Nottingham  
 Holcombe, Rev. G. F....Sherwood Lodge, Nottingham  
 Holder, William...Eastham, Tenbury

Holding, Henry...Fardington, Alton  
 Hole, James...Knowle, Dunster  
 Hole, James...Muskham Woodhouse, Newark  
 Hole, William...Hannaford, Barnstaple  
 Holehouse, J....Llangathock House, Abergavenny  
 Holl, William...Link Tower Lodge, Malvern  
 Holland, Francis D....Crothorne, Pershore  
 †Holland, Dr. Chas....St. Chad's, Lichfield  
 Holland, C....Madeley Pk. Farm, Newcastle, Staffs.  
 Holland, William...Streethay, Lichfield  
 Hollick, Thomas...Llandudno  
 Holliday, James...Lord Street, Liverpool  
 Hollings, John Albert...How Caple, Ross  
 †Hollings, J. C....Snitterfield, Strafod-on-Avon  
 †Hollist, Hasler...Lodsworth, Petworth  
 Holloway, E....Eldon Street, Newcastle-on-Tyne  
 Holloway, Horatio...Marchwood, Southampton  
 Holloway, Thos....Tittenhurst Lodge, Sunninghill  
 †Holloweg, M. de B....Runorva, Nakel, Prussia  
 Holmden, James...Edenbridge  
 Holmes, George...Brooke Lodge, Norwich  
 †Holmes, Gervas...Brockdish Hall, Scole  
 Holmes, Rev. John...Brooke Hall, Norwich  
 Holmes, J....Prospect Place, Globe Lane, Norwich  
 Holroyd, Fred....Knowles Fixby, Huddersfield  
 Holton, George...Wiston Grove, Colchester  
 Holton, William Fifield...Cleeve Prior, Evesham  
 Homer, T. Alner...Tolpuddle, Dorchester, Dorset  
 Homfrey, Samuel...Glen Usk, Caerleon, Newport  
 Hone, H....Stoke Orchard, Cheltenham  
 †Hony, Rev. P. F....25, Old Bond Street, W.  
 Honeywood, William...  
 Honeywood, Mrs....Marks Hall, Kelvedon  
 †Hood, Sir Alex. A., Bt....Bicknoller, Taunton  
 Hooker, John...Oatlands Park, Walton-on-Thames  
 Hooper, Geo...Cottington Court, Deal  
 †Hooper, R. N....Llansannott Ct., Cowbridge, Glamr.  
 †Hope, Joseph...Whoof House, Carlisle  
 Hope, Edwardes Thos. Hen...Moore Park, Ludlow  
 Hope, Sam. Pierce...Bettley Hall, Newcastle, Staff.  
 †Hopkins, Henry...Burnside, Van Dieman's Land  
 Hopkins, John...Tidmarsh House, Reading  
 Hopkinson, John...Manton, Worksop  
 Hopper, George...Fence Houses  
 Hopper, W. Cuthbert...West Hill, Wandsworth, S.W.  
 Hopton, Rev. John...Canon-Frome Court, Ledbury  
 Hopton, Rev. Wm. P....Bishop's Frome, Bromyard  
 †Horley, Thomas, jun....The Fosse, Leamington  
 †Hornby, Rev. Robt....Lythwood Hall, Shrewsbury  
 Hornby, Rev. W....St. Michael's Vicarage, Garstang  
 Hornby, W. H., M.P....Shrewbridge Hall, Nantwich  
 Hornby, Capt. W. R. N....Knowsley Cott., Prescott  
 Horncastle, E....Edwinstowe, Ollerton, Notts.  
 Horncastle, J., jun....Edwinstowe, Ollerton  
 Horne, Thomas...Moreton-in-the-Marsh  
 †Horner, James B....Lincoln  
 Horner, Rev. John...Mells Park, Frome, Somerset  
 Horner, John G....Martins Town, Dorchester  
 Horner, Wm....Hamel's Farm, Puckeridge, Ware  
 Horniblow, William T....Ripple, Tewkesbury  
 Hornsby, Richard...Spittle Gate, Grantham  
 Hornsby, Richard, jun...Spittle Gate, Grantham  
 †Hornycold, J. V....Blackmore Park, Upton-on-Severn

Horrell, John...Stevington, Bedford  
 Horton, George...Harley, Much Wenlock, Salop  
 Horton, Thomas...Harnage Grange, Cressage, Salop  
 †Horton, Wm. Thomas...Seamer House, Yarm  
 Horsfall, T. Berry, M.P....Bellamour Ha., Rugeley  
 Horwood, Matthew...27, Leadenhall Street, E.C.  
 †Hoskins, Thos....Haselbury, Crewkerne, Somerset.  
 †Hoskins, William....North Perrott, Crewkerne  
 Hoskyns, Chandos Wren...Harewood, Ross  
 †Houblon, J. A....Hallingbury Pl., Bishop's Stortfd.  
 †Houblon, Richard Archer...Coopersale, Epping  
 Houghton, S. E....Yacht Tavern, Greenwich, S.E.  
 Houghton, Thomas...Hemshill Manor, Nottingham  
 Houseman, J., M.D....Percy St., Barras Br., New-on-T.  
 †Howard, Hon. C. W. G., M.P....Brampton  
 †Howard, Charles...Biddenham, Bedford  
 Howard, Edward J....Rise Farm, Nocton, Lincoln  
 †Howard, Henry...Greystoke Castle, Penrith  
 †Howard, Hon. James...Hazelby, Newbury  
 †Howard, James...Bedford  
 Howard, Robert...Broughton Hall, Wrexham  
 Howard, R. G. F....Temple Bruer, Lincoln  
 Howard, Wm....Windsor Terrace, Taunton  
 Howden, Alexander...Marston Court, Pembridge  
 Howe, Earl...Gopsall, Atherstone  
 †Howell, Henry...Coates, Cirencester  
 Howell, John...Ewen, Cirencester  
 Howes, E., M.P....Morningthorpe, Long Stratton  
 Howes, P....Hamilton Ter., St. John's Wood, N.W.  
 Howlett, John...Bowthorpe Hall, Norwich  
 Howman, H. A....Bexwell Rectory, Downham Mar.  
 Howse, Nathaniel...Witney  
 Howsin, Daniel...Flintham, Newark, Notts  
 †Hubback, Joseph...Liverpool  
 †Hubbard, Wm. Egerton...St. Leonard's, Horsham  
 Hubbersty, Rev.N....Eastwell Hall, Melton Mowbray  
 Huble, Robert...Barlby Grove, Selby  
 Huddleston, Ferdinand...Swanston Hall, Cambridge  
 Hudson, John...Castleacre Lodge, Brandon  
 †Hudson, T. Moore...Castleacre, Brandon  
 Hudson, Thos....Longford, Market Drayton  
 Hudspith, W....Sycamore House, Haltwhistle  
 Huggup, James...West Sleekburn, Morpeth  
 Hughes, Alfred...Thorness, W. Cowes, Isle of Wight  
 †Hughes, H.R....Kinnel Pk., St. Asaph's, Denbighs.  
 †Hughes, Hugh...Woodgate, Daneshill, Uckfield  
 Hughes, Hugh Robt....Ystrad, Denbigh  
 Hughes, John...Britannia Square, Worcester  
 Hughes, John, jun....Severn Terrace, Worcester  
 Hulme, J. H....Cliff House, Curbar, Calver, Sheffield  
 †Hulme, W....Pembroke Bank, Pembroke, S.Wales  
 †Hulse, Charles...Hall Grove, Bagshot  
 †Humberston, P. S., M.P....Mollington, Chester  
 Humble, G....Elswick Grange, Newcastle-on-Tyne  
 Humble, William Turner...Sealand, Chester  
 Humphry, Wm....Oak Ash, Chaddleworth, Wantage  
 Humphreys, Henry...Woodhouse, Loughboro'  
 Humphries, E....Persnore  
 Humphries, John...Kidderminster  
 Humphries, John...Hampden, Andoversford  
 Humpidge, Thos...Great Woodcote Fm, Carshalton, S.  
 Hunnam...Fenwick, Newcastle-on-Tyne  
 †Hunt, G....Frenchwood, Preston, Lancashire

Hunt, John...Shirley, Southampton  
 Hunt, A. H....Birtley House, Chester-le-Street  
 Hunt, Thomas...Thornington, Coldstream  
 Hunt, William...Leicester  
 Hunt, William...Deeping St. Nicholas, Spalding  
 Hunter, Lt.-Col. Charles...Mount Severn, Llandloes  
 Hunter, George...Wallsend  
 Hunter, Henry...Newcastle-on-Tyne  
 Hunter, Hen. Launoy...Beech Hill, Reading  
 Hunter, J....South Preston Lodge, South Shields  
 Hunter, John Joseph...Wickham Grange, Gateshead  
 Hunter, Patrick...Mt. Alyn, Rossett, Wrexham  
 Hunter, Samuel S....Old Court, Abergavenny  
 Hunter, W....Moor Lodge, Newcastle-on-Tyne  
 †Hunstman, Benjamin...West Retford, Notts  
 Hunting, Charles...South Hetton, Fence Houses  
 Hurle, Joseph Cooke...Brislington, Bath  
 Hurlston, Wm....Heathcote, Wasperton, Warwicksh.  
 Hurrell, William...Newton, Cambridge  
 Hurt, Albert F....Alderwasley, Belper  
 †Huskinson, Thos....Epperstone, Southwell  
 Hussey, Edward...Scotney Castle, Lamberhurst  
 Hussey, Phineas Fowke...Wyrley Grove, Walsall  
 †Hussey, Rich. Hussey...Upwood, Huntingdon  
 Hussey, T....Stud Farm, Skirmett, Henley-on-Tha.  
 Hutchings, Rev. R. S....Monkton Wyld, Charnmouth  
 Hutchinson, Hon. Col. H. K....Weston Ho., Towcester  
 Hutchinson, John...Appleton Lodge, Warrington  
 †Hutchinson, James...Cowley Manor, Cheltenham  
 Hutchinson, John...Brougham Castle, Penrith  
 †Hutchison, Robert...Carlisle, Kirkliston, N.B.  
 Hutley, Jonathan...Rivenhall Hall, Witham  
 Hutt, Rt. Hon. William...Gibside Hall, Gateshead  
 Hutt, John...Water Eaton, Oxford  
 Hutton, J....36, Marley Street, Newcastle-on-Tyne  
 Hutton, Thomas...Upton Gray, Odiham  
 Hutton, William...Gate Burton, Gainsborough  
 Huxtable, Ven. Archd...Sutton Waldron, Blandford  
 †Huyshe, Rev. J....Clysthydon Rectory, Cullompton  
 Hyde, F. C....Ashdown House, East Grinstead  
 Hyde, J. T., M.A....Island of Herm, Guernsey  
 Hyett, John Edw....Haydon's Elm, Cheltenham  
 Hyett, W. H....Painswick, Gloucestershire  
 Hymers, Joseph A....Whickham Park, Gateshead

# I.

Ide, John...West Wittering, Chichester  
 Ilderton, Rev. T....Felton, Acklington, Northumb.  
 Iles, Daniel...Fairford Retreat, Fairford  
 †Iles, Francis...Barnoldby-le-Beck, Grimsby  
 Iles, John...Binbrook Hill, Market Rasen  
 Impey, William...Broomfield Hall, Chelmsford  
 Inge, Chas. Henry...Whittington Hurst, Lichfield  
 Inge, Col. Wm....Thorpe, Tamworth  
 Ingham, Robert...Westor, South Shields  
 Ingram, Hugo F. M....Hoarcross, Rugeley, Staffords  
 †Ingram, John A....Wylie, Heytesbury  
 †Ingram, Joseph...Pleck House, Accrington  
 Ingram, William...Armley, Leeds  
 Insole, James Harvey...Ely Court, Llandaff  
 †Innes, William...Field Place, Warnham, Horsham



†Ireland, J. Ireland Clayfield...Brislington, Bristol  
 Ireland, John Smith...Forthampton, Tewkesbury  
 Irving, Clark...8, Hyde Park Square, London, W.  
 Isaac, John Whitmore...Boughton, Worcester  
 Isaacson, John...Clare, Suffolk  
 Isaacson, Wm. Parr...Newmarket  
 Isham, Sir C. E., Bart...Lampport Hall, Northampton  
 Isham, Rev. R...Lampport Rectory, Northampton  
 Isherwood, Arthur B...Tynhalig, Trefnant, Rhyl  
 Ive, Edward P...Langley, Slough  
 Ive, John G...The Trenches, Langley, Slough  
 Ives, Capt. Ferdinand...St. Catherine's Hill, Norwich  
 Izon, John B...Walsgrave-on-Sowe, Coventry

## J.

Jackson, Daniel...Chadwell Place, Grays, Essex  
 Jackson, F...6, Carlton Place, Newcastle-on-Tyne  
 Jackson, G. F...Alcester Lodge, Bromsgrove  
 Jackson, J...Aynscomb House, Orpington, Kent  
 Jackson, Matthew...Bilthorpe, Newark, Notts  
 Jackson, P. R...Blackbrook, Gresmont, Hereford  
 Jackson, Richard...Noctourm, Birkenhead  
 Jackson, Thomas...Eltham Park, Kent  
 †Jackson, William...Oak Bank, Carlisle  
 Jackson, William Fenwick...Newcastle-on-Tyne  
 Jackson, Wm. Kay...Barbot Hall, Rotherham  
 †Jacobsen, C. C...Cranham Farm, Cirencester  
 Jacson, Chas. Roger...Barton, Preston, Lancashire  
 Jaggard, Joseph...Leek Wooton, Warwick  
 James, Edward...Holeyn Hall, Newcastle-on-Tyne  
 James, Isaac...Tivoli, Cheltenham  
 James, Jas...North Sodston, Narberth, Pembroksh.  
 James, James William...Mappowder, Blandford  
 James, J. A...Bridge Town Farm, Stratford-on-Avon  
 James, Richard...High Street, Haverfordwest  
 James, Richard...Llanrwst  
 James, T...Otterburn Tower, Newcastle-on-Tyne  
 James, Sir Walter C., Bt...Betteshanger, Sandwich  
 †James, Capt. Wm. E...Barrack Park, Carlisle  
 Jameson, Thomas...Newcastle-on-Tyne  
 †Jaques, Leonard...Easby Abbey, Richmond, Yorks.  
 Jaques, R. M...Easby Abbey, Richmond, Yorks.  
 Jaques, T. G...Staddlethorpe, Howden, Yorkshire  
 †Jarrett, John...Camerton House, Bath  
 Jarvis, Sir Raymond, Bt...Cove Cottage, Ventnor  
 Jarvis, T. A...Higher Bolberry, Kingsbridge, Devon  
 †Javry, John...46, West Seventeenth St., New York  
 Jefferson, Henry...Rotherhyke, Whitehaven  
 Jefferson, Rev. J. Dunnington...Thicket Priory, York  
 Jefferson, Cpt. J...Ballaughton Ho., Douglas, I. of Man  
 †Jefferson, Robert...Preston Hows, Whitehaven  
 Jeffreys, N. N...Hollybrook Ho., Shirley, Southamp.  
 Jeggo, Thos. B...Mounts, Great Saling, Braintree  
 †Jegon, Trew...Slough  
 Jekyll, J...Carholme Terrace, Newland, Lincoln  
 †Jenkins, John B...Kingstone House, Abingdon  
 Jenkins, Richard David...The Priory, Cardigan  
 †Jenkinson, Sir George, Bt...Eastwood, Berkeley  
 Jenkinson, Joshua...Anfield, Cockermouth  
 †Jenner, George...Parsonage House, Udimore, Rye  
 Jennings, Richard...Carmarthen

Jervis, Hon. E. Swinfen...Aston Park, Staffordsh.  
 †Jervoise, F. E. J...Herriard Park, Basingstoke  
 Jessop, Joseph...Grove Farm, Chiswick, W.  
 †Jobez, Charles...17, Boulevard Madeleine, Paris  
 Jobling, Edward...Hill Top Cottage, Carlisle  
 Jobling, George...Tynemouth  
 Jobling, J...Framlington Place, Newcastle-on-Tyne  
 Jobling, Mark L...Newcastle-on-Tyne  
 Jobling, T. W...Point Pleasant, Newcastle-on-Tyne  
 Jobson, William...Buteland, Hexham  
 †Jodrell, Sir Edw. R., Bt...64, Portland Place, W.  
 Johnson, A. H...Manor House, Acton, W.  
 Johnson, A. H., jun...Hanger Hill Farm, Ealing, W.  
 Johnson, C. E...5, South Parade, Newcastle-on-Tyne  
 Johnson, Charles W...25, Mark Lane, E.C.  
 Johnson, Cuthbert Wm...Waldronhurst, Croydon  
 Johnson, C. W...Manor Cot., Larkball Rise, Clapham  
 Johnson, Edward...The Deanery, Chester-le-Street  
 Johnson, E. W...Chichester  
 Johnson, Francis Dixon...Apleyheads, Durham  
 †Johnson, George...Blaco Hill, Retford, Notts  
 †Johnson, Rev. H. L...Binderton Ho., Chichester  
 Johnson, Isaac...Blaydon-on-Tyne  
 Johnson, James...East Harptree, Bristol  
 Johnson, John...South Pickenham, Swaffham  
 Johnson, Joseph...Windsor  
 Johnson, Rev. P...Wimborthy, Chumleigh, Devon  
 Johnson, R. S...Haswell Colliery, Fence Houses  
 †Johnson, R. W...Bricklehampton Hall, Pershore  
 Johnson, Thomas...Ellington, Morpeth  
 Johnson, T. C...Chevet, Wakefield  
 Johnson, Thomas...Halton Grange, Runcorn  
 Johnson, Thomas...The Hermitage, Frodsham  
 †Johnson, Thomas...Whittlesea, Cambridgeshire  
 Johnson, Walter...Trench Hall, Gateshead  
 Johnson, Walter F...Leicester  
 †Johnston, Alex. R...The Grove, Yoxford, Suffolk  
 Johnston, J. Lindsay...Crandall, Farnham, Surrey  
 Johnstone, Edward...3, King's Bench Walk, E.C.  
 †Johnstone, Rev. George...Broughton, Hunts  
 †Johnstone, J. C. H...Hardwick Hall, Durham  
 †Johnstone, W. R...Hardwick Hall, Ferryhill  
 Joicey, Edward...Newcastle-on-Tyne  
 Joicey, John...Urpeth Lodge, Fence Houses  
 Jollands, William D...Buxshalls, Lindfield, Sussex  
 †Jolliffe, Sir W. G. H., Bt, M.P...Heath Ho., Petersfield  
 Jonas, John Carter...3, St. Mary Street, Cambridge  
 Jonas, Samuel...Chrishall Grange, Saffron Walden  
 Jones, Benjamin...Talardd, Llanybyther, Carmarthen  
 †Jones, David, M.P...Pantglas, Carmarthen  
 Jones, Edward...6, York Crescent, Clifton, Bristol  
 Jones, George...Stareton, Kenilworth  
 Jones, George...Whiston Lodge, Penkridge  
 Jones, G...Whitley Ct., Upton St. Leonard's, Glouc.  
 Jones, Hugh...Llanllyfn, Caernarvon  
 Jones, Harvey Bowen...49, Montagu Square, W.  
 Jones, H. P...Portway House, Warminster  
 †Jones, James Cove...Loxley, Warwick  
 †Jones, John...Blaeno's, Llandovery, S. Wales  
 Jones, John...Bryn Adda, Dolgelly  
 †Jones, J. E...Springfield, Braunton, Hereford  
 Jones, R. Hesketh...North Brook House, Dover  
 Jones, R. P...The Hermitage, Whitchurch, Salop



†Jones, Sir W., Bt....Cranmer Hall, Fakenham  
 Jones, W. H....Canon Bridge, Madley, Hereford  
 †Jones, Wm....Harrington, Shiffnal  
 Jones, W. Hope....Hooton Farm, Sutton, Cheshire  
 †Jones, W. B....Lissdale, Clonakilly, Ireland  
 Jordan, Francis....Eastburn, Driffield  
 Jordan, Joseph....Hardwick Terrace, Gateshead  
 Jordan, Wm....Charlton Kings, Cheltenham  
 Josling Geo. F....Berners Roding Hall, Dunmow  
 Jowett, Rev. J. F....Kingston, Bagpuze, Abingdon  
 Jowitt, Christopher....Palterton, Chesterfield  
 Joyce, Charles....Bishopsgate House, Egham  
 Joyce, Thomas....Vale Farm, Sudbury, Harrow, N.W.  
 Jukes, Mrs. Mary....Cotwall, Wellington, Salop  
 †Justice, Henry....Hinstock, Market Drayton

## K.

†Karslake, Rev. W. H....Mesham, Southmolton  
 †Kay, J. R....Bass Lane House, Bury, Lancashire  
 Kay, R....Forcett Valley, Darlington  
 Kearsey, Charles....Glewstone, Ross  
 Keary, H. W....Aldenham, Bridgenorth  
 Keeling, Charles....Congreve, Penkridge  
 Keeling, Chas. R....Yew Tree Farm, Penkridge  
 †Keene, Rev. C. E. R....Swincombe Ho., Nettlebed  
 Keep, Richard....Aldermaston, Reading  
 Kekewich, S. Trehawke, M.P....Peamore, Exeter  
 Kelham, Robert....Bleasby Hall, Southwell  
 †Kelsall, H., jun....Pinnacle Hill, Kelso, N.B.  
 †Kemble, Horatio....Potter's Bar, Barnet, Herts  
 †Kemble, Thomas....Runwell Hall, Chelmsford  
 Kemp, Jesse....Thurby Grange, Alford  
 Kendrick, Edward....Weeford, Lichfield  
 †Kennaway, Sir John, Bart....Escot, Honiton  
 Kennedy, David....Oriental Club, W.  
 Kennedy, Charles Burton....Kirklands, Ulverstone  
 Kennedy, Myles....Burton Cottage, Ulverstone  
 Kennedy, Primrose W....Drumellan, Ayr  
 Kennedy, Rt. Hon. T. F....Dalquharran Castle, N.B.  
 Kenrich, George....Thurgarton Hill, Southwell  
 †Kensington, Edward Thomas....Moolham, Ilminster  
 †Kenyon, Hon. E....Macefen, Whitechurch, Salop  
 †Kerrich, John....Geldeston Hall, Beccles  
 Kerry, the Knt. of (P. Fitzgerald)...Kerry  
 Kersey, Clement....Whitton, Ipswich  
 Kersey, James....Farlton Farm, Cirencester  
 †Kesterton, Thomas....Sutton, S.  
 Kett, George Samuel....Brook House, Norwich  
 †Kettle, Geo. Mackenzie....Dallcott Ho., Bridgenorth  
 Key, Sir Kingsmill Grove, Bt....95, Newgate St., E.C.  
 Keyes, Hen. James....Ashington, Rochford, Essex  
 †Keyworth, Henry Joseph....Cottesford Pl., Lincoln  
 †Keyworth, J. R. Haldenby....Greestone Ho., Lincoln  
 Kibble, Thomas....Green Trees, Tunbridge  
 Kiddle, F. G....Moreton, Dorchester  
 Killick, Arthur....Deepdene Park Farm, Dorking  
 Kimber, Jas. Weaving....Tubney Warren, Abingdon  
 Kimber, Thomas....Great Tew, Enstone  
 Kimberley, John Parrier....Gloucester  
 Kindersley, E. Leigh....Syward Lodge, Dorchester  
 King, C....North Lodge Farm, Potter's Bar, Barnet

King, Charles Allen....98, Piccadilly, W.  
 King, George....Saffron Walden  
 King, James K., M.P....Staunton Park, Leominster  
 King, John G....Beeton, Newbury  
 King, John L....Thorp Abbots, Scole Inn, Norfolk  
 King, Rev. J. Meyers....Cutcombe Vicarage, Dunster  
 King, Hon. J. P. L., M.P....Woburn Pk., Chertsey  
 King, Richard King Meade....Walford, Taunton  
 King, Richard H....Woopterton, Alnwick  
 King, R. Meade....Pyrland Hall, Taunton  
 King, S....Bockhampton Farm, Lambourne, Berks  
 King, William....Barton, Bury St. Edmund's  
 King, W. C....Warfield Hall, Bracknell  
 Kingdon, Rev. S. N....Bridgerule Vicar, Holsworthly  
 Kingdon, Samuel....Layrick, Thorverton  
 Kingsley, Thomas....Boarscroft, Tring  
 †Kingscote, Col. R. N. F., M.P....Kingscote, Glouc.  
 Kingsford, John....Esher, Surrey  
 †Kingsmill, Wm....Sydmonton Park, Newbury  
 †Kingsnorth, Alfred....Great Chart, Ashford, Kent  
 †Kingsnorth, Edward....Brookland, New Romney  
 Kinloch, Colonel....Logie, Kirriemuir, N.B.  
 Kinnaird, Lord....Rossie Priory, Inchture, Perthshire  
 †Kirk, R....Gale Bank, Leybourne, Wensleydale  
 Kirkaldie, Viscount....Windsor  
 Kirkby, Thomas....Cuxwold, Caistor  
 Kirkham, Thomas....Biscathorpe House, Louth  
 Kirkland, Sir John, Bt....17, Whitehall Place, S.W.  
 Kirkpatrick, Capt. John....Monk's Horton, Hythe  
 Kirwan, J. Stratford....Moynay, Ballyglunin, co. Galway  
 Kitson, James....Leeds  
 Kitson, William....Torquay  
 Knapping, Dale....Sutton, So. Shobury, Ingatstone  
 Knatchbull, Rev. W....Cholderton Lodge, Amesbury  
 †Knatchbull, Wm....Babington, Frome, Somerset.  
 †Knight, A. J. R. B....Downton Castle, Leintwardine  
 Knight, Edward....Chawton House, Alton  
 †Knight, E....High Leaddon, Newent, Gloucestersh.  
 Knight, John....Widness, Warrington  
 Knight, John....Forthampton, Tewkesbury  
 Knight, R. Farthing....Hereford  
 Knight, Thomas....Norlington, Lewes  
 Knight, Thos. Henry....Stoke Canon Vicarage, Devon  
 †Knighton, Sir W., Bt....Blendworth Ldg., Horndean  
 Knollys, J. E....Fitzhead Court, Taunton  
 Knollys, Gen....Blount's Court, Henley, Oxon  
 Knowles, James....Wetherby  
 Knox, Octavius N....Corrig Lodge, Foynes, Ireland  
 Kyrke, Rich. V....Stansby Lodge, Wrexham

## L.

Laidlaw, Adam....Greenfield Place, Newc.-on-Tyne  
 Laidman, C. J....Royal Arcade, Newcastle-on-Tyne  
 †Lake Edward....Hill Side, Strood, Kent  
 Lake, James....Newlands, Teynham, Sittingbourne  
 Lake, Robert....Milton, Canterbury  
 Lakeman, John....Costislow, Bodmin  
 Lakin, Henry....Link End, Malvern  
 Lamb, R. O....Axwell Park, Gateshead  
 †Lamb, William....Hay Carr, Ellet, Lancaster  
 Lambe, John....Church Bank, Bowdon, Manchester

†Lambert, Chas...Sunk Island, Otteringham, Hull  
 †Lambert, Henry T....74, Grosvenor Street, W.  
 Lambert, Wm. Chas...Misterton, Crewkerne  
 †Lancaster, T....Bownham Ho., Stroud, Gloucestersh.  
 †Landor, H. Eyres...Tachbrook, Leamington  
 Lane, John...Barton Mills, Cirencester  
 Lane, Ebenezer...Honey Street, Marlborough  
 Lane, John...Wenlock Brewery, City Road, E.C.  
 †Lane, William...Broadfield, Northleach  
 †Langdale, Lady...Eywood, Kington, Herefordsh.  
 Langdale, Hon.C...Houghton Hall, Market Weighton  
 Langdale, Sampson...Newton Red Ho., Morpeth  
 Langdale, Wm. Atkinson...Holmwood Pk., Dorking  
 Langdon, William...Ashford House, Barnstaple  
 Lange, W. J. M...West Ho., Whitburn Sunderland  
 Langham, Herbert...Cottesbrooke, Northampton  
 Langlands, John Charles...Old Bewick, Alnwick  
 †Langton, W. H. P. Gore, M.P...Newton Pk., Bath  
 Lansdowne, Marquis of...Bowood, Calne  
 Large, William...Taywell House, Goudhurst  
 †Lascelles, Hon. G. E...Moor Hill, Harewood, Leeds  
 La Touche, Col. David...Marlay, Dublin  
 Latham, Geo. William...Bradwall Hall, Sandbach  
 Lathbury, George...Wetmoor Hall, Burton-on-Tr.  
 Lauder, Joseph...Burton, Christchurch  
 Laverack, Samuel S...Redness Hall, Goole  
 Laverack, Samuel...Chapel Haddelsey, Selby  
 †Law, Rev. R. V...Christian Maford, Chippenham  
 Lawes, J. Bennet...Rothamsted Park, St. Albans  
 †Lawford, Thomas, jun...London, Canada West  
 †Lawley, Hon. & Rev. S. W...Escrick Rectory, York  
 Lawrence, Charles...Cirencester  
 Lawrence, J...Great House, Churchdown, Gloucester  
 Lawrence, Thomas...Churchdown, Gloucester  
 †Lawrie, Andrew...Mount Mascall, North Cray  
 †Lawson, C...George the Fourth Bridge, Edinburgh  
 †Lawson, Chas., jun...34, George Square, Edinburgh  
 Lawson, E...Redesdale Cottage, Newcastle-on-Tyne  
 Lawson, Rev. Edw...Longhirst Hall, Morpeth  
 Lawson, Wilfrid, M.P...Brayton, Carlisle  
 Lawton, Sir Wm., Bart...Brough Hall, Catterick  
 †Lawson, William...Brayton Hall, Carlisle  
 Lax, William...East Heaton, Newcastle-on-Tyne  
 Lay, Rev. John Ward...Hele, Ashburton  
 †Lay, John W...3, Savage Gardens, Tower Hill, E.C.  
 Laycock, Joseph...Seghill House, Northumberland  
 Laycock, Richard...Winlaton, Newcastle-on-Tyne  
 Laycock, Robert...Winlaton, Newcastle-on-Tyne  
 Laycock, Rt., jun...Low Gosforth, Newc.-on-Tyne  
 Layton, R. Marton...Thorney Abbey, Peterborough  
 Lea, John Wheelley...Stanfield House, Worcester  
 Leach, Henry...Corston, Pembroke  
 Leach, John...Ivy Tower, Tenby  
 Leader, Nicholas...Dromagh, Bonteene, Ireland  
 Leathart, Jas...12, Framlington Pl., Newc.-on-Tyne  
 Leather, George...Knostrup, Leeds  
 Leather, Simeon...Delamere, Northwick  
 †Leaver, Francis...Longnor Hall, Penkridge  
 †Lechmere, Sir E. A. H., Bt...Upton-on-Severn  
 Le Cornu, Charles Philip...Beaumont, Jersey  
 Ledger, Keuben...Grove House, W. Derby, Liverpool  
 Lee, Charles...Grantley Hall, Ripon  
 Lee, Daniel Jas...4, Bedford Row, Gray's Inn, W.C.

Lee, Edward...Stocksfield Hall, Newcastle-on-Tyne  
 Lee, Jesse...Church Gate, Leicester  
 Lee, Capt. John...Woolley Firs, Maidenhead  
 Lee, John Bunting...Stocksfield Hl., Newc.-on-Tyne  
 Lee, Joseph...Dilston, Hexham  
 Lee, Joseph Henry...Redbrook, Whitchurch, Salop  
 †Lee, J. Lee...Dillington House, Ilminster  
 Lee, Matthew...Wester Hall, Hexham  
 Lee, Thomas...78, Westbourne Park Villas, W.  
 †Lee, Vaughan H...Lanelay, Llantrissant, S. Wales  
 Leech, John...Wall Hill, Leek  
 Leedham, William...Andover  
 Leeds, Henry...Stibbington, Wansford, Northampt.  
 †Leeds, Robt...Lexham, Castleacre, Brandon  
 Leeke, R...Longford Hall, Newport, Shropshire  
 Lees, John...Reigate  
 Lees, William...Blacon Hall, Chester  
 Leese, Benjamin...Eastling, Faversham  
 Leese, Chas. Stewart...Divan Ct., Eastling, Faversham.  
 Le Feuvre, H. J...Les Niemes, St. Peter's, Jersey  
 Le Gallais, Albert...La Moire House, Jersey  
 Legard, George...Easthorpe Hall, Malton  
 Legard, Capt. James A...Cotes  
 Legg, Thomas...Burton Bradstock, Bridport  
 Leggatt, H. B...Brownwich, Fareham  
 Leggatt, S. B...Crofton, Titchfield  
 Legge, Benj...Court Ho., Litton Cheney, Dorchester  
 Leigh, G. Cornwall, M.P...High Leigh, Warrington  
 Le Grand, Emile...Woodhorn, Morpeth  
 Leigh, F. A...Rosegarland, Foulksmill, co. Wexford  
 Leigh, John Gerard...The Hoo, Luton  
 Leigh, John Shaw...The Hoo, Luton  
 Leigh, W., jun...Woodchester Park, Gloucestershire  
 Leighton, Sir Baldwin, Bt., M.P...Luton, Shrewsb.  
 Leighton, Robert...Thistlehaugh, Morpeth  
 Leir, Rev. W. M...Ditcheat Rectory, Castle Cary  
 †Leith, Sir A., Bt...Glenkindie, Iverkindie, Aberdeen.  
 Lempriere, Rev. William...Royal Manor, Jersey  
 Leney, Charles...Lenner, East Peckham, Kent  
 Lennard, Col. J. F...Wickham Court, Bromley  
 †Lennard, Sir T. B., Bt...Belhus, Avelly, Romford, E.  
 Lennox, William...Six Mile Bridge, Newc.-on-Tyne  
 Leonard, Charles...Castle Camps, Linton, Cambs.  
 Leslie, Charles Powell...Glasslough, Ireland  
 Lethbridge, Ambrose Goddard...Bank, Taunton  
 †Lethbridge, Charles...Eastbrook House, Taunton  
 Levett, William...Glassenbury, Cranbrook  
 Lewes, Col. John...Llanllan, Talsarn, Carmarthen  
 Lewes, Rev. Thomas...Taynton, Burford, Oxon  
 Lewis, David...Stradey, Llanelly, Carmarthen  
 Lewis, Edward...Pickhill Hall Farm, Wrexham  
 Lewis, G...Audley, Newcastle-under-Lyme  
 Lewis, I. H...Gallants Ct., East Farleigh, Maidstone  
 Lewis, J. L. G. R...Henllan, Narberth, Pembroke  
 Lewis, Rich. Ed...Weston, Monk Hopton, Bridgnth.  
 Lewis, S...Audley, Newcastle-under-Lyme  
 Lewis, Thomas...Norchard, Tenby  
 Lewis, T. F...Newport, Monmouthshire  
 Lewis, W. H...Clynffew, Newcastle Emlyn  
 Lewis, Wyndham W...Llanishew House, Cardiff  
 Ley, John Henry...Trehill, Exeter  
 Leyshon, Robert...Island Farm, Bridgend  
 Lichfield, Earl of...Shugborough, Staffordshire

Liddell, Annie...Newcastle-on-Tyne  
 Liddell, Edward...Jesmond, Newcastle-on-Tyne  
 Lightfoot, F. L...University College, Oxford  
 Lilley, A...Bassingbourn, Royston  
 Linaker, P...Norton Hill, Preston Brook, Cheshire  
 Lindley, Urban...Radmanthwaite House, Mansfield  
 Lindsay, Hugh H...West Dean House, Chichester  
 Lindsay, Col. R. Lloyd...Lockinge, Wantage  
 Lindsell, Lieut.-Col...Fairfield House, Biggleswade  
 Linley, William...Sutton, S.  
 †Linton, Rev. J...Hemingford Ho., St. Ives, Hunts  
 Linton, John...Westwick House, Cambridge  
 Lintott, Wm...Holmbush, Slinfold, Horsham  
 Lintze, Robert G...Jermyns, Romsey  
 Lister, Clement...West Elswick Villa, Newc.-on-Tyne  
 Litchfield, John...Epperstone, Nottingham  
 Little, Edward...Lanhill, Chippenham  
 Little, Hack Magnus...Elmington, Oundle  
 Little, Wm. H...Llanvair Grange, Abergavenny  
 Littledale, Harold...Liscard, Liverpool  
 Littledale, Henry...Cardington, Bedford  
 †Livesey, Rev. Thos...Stourton Hall, Horncastle  
 †Llewellyn, R...Tregwynt, Fishguard, Pembrokesh.  
 Llewellyn, Wm...Courtcolman, Bridgend, S.Wales  
 †Lloyd, Arthur P...Shawbury, Shrewsbury  
 Lloyd, Edw. Harvey...Aston Hall, Oswestry  
 Lloyd, Francis...Foundry, Worcester  
 Lloyd, George Woodhall...Whitechurch, Monmouth  
 Lloyd, John...Astwich Manor House, Hatfield  
 Lloyd, L. A...Leaton Knolls, Shrewsbury  
 Lloyd, Llewellyn F...Nannerch Hall, Mold  
 Lloyd, Rev. Thos...Rectory, Christleton, Chester  
 Lloyd, William Butler...Monkmoor, Shrewsbury  
 Loader, J...Firgrove Farm, Whitechurch, Hants  
 †Lobb, Geo., jun...Lawhitton, Launceston, Cornwall  
 †Locker, Wm. J...Tillington House, Stafford  
 †Locock, Sir C., Bt...Holmewood, Tunbridge Wells  
 †Locock, Edmund...South Elkington, Louth  
 †Locock, Fred...26, Hertford Street, May Fair, W.  
 †Loesch, H...Cammerswaldau, Hirschberg, Prussia  
 Logan, J...Maindee House, Newport, Monmouthsh.  
 Londesborough, Lord...Grimston, Tadcaster  
 Long, Alexander Wearing...Mint Cottage, Kendal  
 Long, Daniel...Waddon, Gloucester  
 Long, H. Laws...Hampton Lodge, Farnham, Surrey  
 †Long, Kellett...Dunstan Hall, Norwich  
 †Long, Rich. P...Dolforgan, Newtown, Montgom.  
 Long, Walter...Preshaw House, Bishop's Waltham  
 Long, W. Jervis...Preshaw Ho., Bishop's Waltham  
 †Longbourne, W. T...4, South Sq., Gray's Inn, W.C.  
 †Longcroft, C. J...Havant  
 Longcroft, C. R...Llanina, Aberayron  
 †Longe, John...Spixworth Park, Norwich  
 †Longford, Earl of...Pakenham Hall, Westmeath  
 Longland, James...Grendon, Northampton  
 †Loomes, Edward...Whittlesea, Cambridgeshire  
 †Lopes, Sir Massey, Bart., M.P...Maristow, Plymouth  
 Loraine, Edward...The Riding, Newcastle-on-Tyne  
 †Lord, John...Elmley Park, Pershore  
 Lord, Capt. John P...Hallow Park, Worcester  
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 †Lovaine, Lord...Albury Park, Guildford  
 Love, Peter...Northampton

Love, Samuel...Castle Farm, Shoreham, Sevenoaks  
 Loveday, John...Williamscoote, Banbury  
 †Lovell, Edward W. L...The Meads, Eastbourne  
 †Lovell, Edwin...Dinder, Wells, Somerset  
 †Lovell, Thomas...Winwick Warren, Rugby  
 Lovett, Joseph Venables...Belmont, Chirk  
 Lowe, Edward...Comberford Mill, Tamworth  
 Lowe, John...Ryhall, Stamford  
 Lowe, John...Whitmore House, Birmingham  
 Lowe, John...Bridge Farm, Handley, Chester  
 Lowe, John...Wheelock Heath, Sandbach  
 Lowe, Joseph...Stackton Hall, Malpas  
 Lowe, Peter...Marston, Stafford  
 Lowe, Thomas...Calverley Hall, Handley, Chester  
 †Lowndes, Geo. Alan...Barrington Hall, Harlow  
 †Lowndes, W. L...Linley Hall, Bridgnorth, Salop  
 Lownds, J. R...Dene Ho., Walker, Newc.-on-Tyne  
 Lowrey, E...Broomhaugh, Riding Mill, Northum.  
 Lowrey, Wm...Barmoor, Berwick-on-Tweed  
 Loxley, John Dingley...Charlton, Pershore  
 †Loyd, Ed., jun...Litlesden Ho., Hawkhurst, Kent  
 †Loyd, Wm. Jones...Langleybury, Watford  
 †Lubbock, Sir J. Wm., Bt...High Elms, Farnboro'  
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 †Lucas, Bernard...Chesterfield  
 Lucas, George...Filby House, Great Yarmouth  
 †Lucas, Lieut. Richard...Edith Weston, Stamford  
 Luckock, Howard...Oak Hill, Edgbaston, Birmingham.  
 Luckham, Levi...Broadway, Weymouth  
 Lucy, Rev. J...Hampton Lucy, Stratford-on-Avon  
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 Ludolf, Henry...Headingley Lane, Leeds  
 Luff, John W...Canford, Wimborne  
 †Lugar, Henry...Hengrave, Bury St. Edmund's  
 Lumley, Robert...Black Hedley, Shotley Bridge  
 Lund, Capt. Thos...Lovely Hall, Blackburn  
 Lungley, Brooke M...Peyton Hall, Boxford, Suffolk  
 Lunn, Robert...Norton, Evesham  
 †Lupton, Arthur...Newton Hall, Leeds  
 †Lushington, C. Manners...  
 Lutener, Thomas...Keele, Newcastle, Staffordshire  
 †Lutteroth, Robert...Hamburg  
 Luttrell, Rev. Alex. H. F...Minehead, Taunton  
 †Lyll, William...Balmakervian, Montrose, N.B.  
 Lyell, Thomas...Shielhill, Kirriemuir, N.B.  
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 †Lyne, Robert L...Oddington, Stow-on-the-Wold  
 Lyne, Wm...Oddington, Stow-on-the-Wold  
 †Lynes, G. Boulton...Hackleton Ho., Northampton  
 Lynn, John...Church Farm, Stroxtan, Grantham  
 Lyon, Capt. T. D...  
 Lysley, Wm. John...Mimwood, Potter's Bar, Herts  
 Lyveden, Lord...Farming Woods, Thrapstone

M.

Mabbett, John...Stinchcombe, Dursley, Gloucester  
 Maberley, Hon. Mrs...Shute House, Axminster  
 M'Cann, George...Court Farm, Malvern  
 McChesney, J. H...Newcastle-on-Tyne  
 †Macclesfield, Earl of...Sherburn Castle, Tetsworth



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 MacConnell, F. . . . Robgill Tower, Ecclefechan, N. B.  
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 †MacDowall, J. C. S. . . . Sydney, New South Wales  
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 †MacEwen, James. . . . Clonshire, Croagh, Limerick  
 McGeorge, John. . . . Goudhurst, Staplehurst  
 Machin, J. Vessey. . . . Gateford Hall, Worksop  
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 Mackay, Thos. Henry. . . . Petham House, Canterbury  
 †Mackenzie, E. . . . Fawley Court, Henley-on-Thames  
 †MacIntosh, David. . . . Havering, Romford, E.  
 Mackenzie, John. . . . Worcester  
 Mackinder, Herbert. . . . Mere Hall, Lincoln  
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 McLaren, Henry. . . . Hylton Castle, Sunderland  
 M'Laren, James. . . .  
 McLaren, Peter. . . . West House, Marley Hill  
 McLaren, Wm. . . . North Gosforth, Newc.-on-Tyne  
 McLaughlin, W. G. . . . Duncombe Park, Helmsley  
 Maclean, Allan, M. D. . . . Colchester  
 †MacLeod, Norman. . . .  
 †MacNiven, Charles. . . . Perrysfield, Oxted, Surrey  
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 Maddison, R. T. . . . Wandon, Belford  
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 Maddox, John. . . . Harley, Much Wenlock  
 †Madgwick, Wm., jun. . . . Alciston, Lewes  
 †Mahon, H. J. P. . . . Strokestown House, Roscommon  
 Maidens, Thomas Cousins. . . . Brinkhill, Spilsby  
 Main, James. . . . 13, Rye Hill, Newcast-on-Tyne  
 †Mainwaring, Townshend. . . . Galtfaenan, Denbigh  
 †Maitland, Col. Fred. Thos. . . . Babbicombe, Torquay  
 †Maitland, J. G. . . . Surrey Villa, Lambeth, S.  
 Majendie, Ashhurst. . . . Castle Hedingham, Essex  
 Makgill, George. . . . Prestbury, Cheltenham  
 †Malcolm, Maj.-Gen. G. A. . . . 67, Sloane Street, S. W.  
 †Malcolm, John. . . . 7, Great Stanhope Street, W.  
 Malcolm, M. . . . Manor House, Kineton, Warwicksh.  
 Male, Henry. . . . East Chinnock, Yeovil  
 Malloch, C. H. . . . Court House, Cockington, Torquay  
 †Malmesbury, Earl of. . . . Heron Court, Christchurch  
 †Maltby, Edward Harvey. . . . G 3, Albany, W.  
 †Manchester, Duke of. . . . Kimbolton Castle, Hunts  
 †Mangles, F. . . . Down Farm, Compton, Guildford  
 Mangles, George. . . . Givendale Grange, Ripon  
 Mangles, Ross D. . . . Stoke, Guildford  
 Mann, Henry. . . . The Asps, Warwick  
 Mann, H. . . . 9, Woburn Builds., Euston Sq., N. W.  
 Mann, John. . . . Thornage, Thetford  
 Manning, Henry. . . . 251, High Holborn, W. C.  
 Manning, John. . . . Orlingbury, Wellingborough  
 Mannings, George. . . . Downton, Salisbury  
 †Mannsfield, Count. . . . Dobrich, Prag, Austria  
 Mansel, J. C. . . . Whatcombe, Blandford, Dorset  
 Mansel, Raleigh A. . . . Heathfield, Swansea  
 †Mansell, Sir John, Bart. . . . Maesdeilo, Llandilo  
 Mansell, Thomas. . . . Adcott Hall, Baschurch Salop

Mapplebeck, W. B. . . . 6, Bull Ring, Birmingham  
 March, Thomas. . . . Blaydon Bank, Blaydon-on-Tyne  
 †Margary, Maj. A. R. . . . Chartham Pk., E. Grinstead  
 Margesson, Rev. W. . . . 4, Green's Row, Chelsea, S. W.  
 Margetson, James. . . . Manor House, Shalden, Alton  
 †Margetts, Charles. . . . Huntingdon  
 Margetts, John. . . . High Street, Warwick  
 Marjoribanks, E. . . . Greenlands, Henley-on-Thames  
 †Marjoribanks, D. C. . . . Bushey Hall Farm, Watford  
 †Marjoribanks, Edward, jun. . . . 59, Strand, W. C.  
 †Marjoribanks, Stewart M. P. . . . Bushy Grove, Watford  
 Markby, John Randall. . . . 9, Whitehall Place, S. W.  
 †Markham, Charles, jun. . . . Northampton  
 Markham, Lt.-Col. W. T. . . . Becca Hall, Milford Junc.  
 Marmont, James. . . . Bristol  
 Marriage, John. . . . Grassmere, Mitcham, S.  
 Marriott, Capt. E. J. Beckett. . . . Avon Bank, Pershore  
 Marriott, H. C. . . . Narborough, Brandon  
 Marriott, Rev. J. P. . . . Cotesbach, Lutterworth  
 †Marriott, W. M. . . . Kibworth, Market Harborough  
 Marris, Thomas. . . . Ulceby, Lincolnshire  
 Marsh, Matthew H., M. P. . . . Chilbury Ho., Salisbury  
 Marsh, Richard. . . . Sandwich  
 Marsh, Thomas. . . . The Heamies, Stone, Staffordshire  
 Marsh, Wm. Jas. . . . Loridge, Berkeley, Gloucestersh.  
 †Marshall, Arthur. . . . Headingley, Leeds  
 Marshall, Rev. C. . . . Ripley Court, Ripley, Surrey  
 †Marshall, Edmond H. . . . Westwood Hall, Leeds  
 Marshall, Fred. Chas. . . . Riseholme, Lincoln  
 †Marshall, Geo. H. . . . 32, St. George's Rd., Pimlico  
 Marshall, H. J. . . . Poulton Priory, Cricklade  
 Marshall, James. . . . West Hartford, Bedfordton  
 †Marshall, James Garth. . . . Headingley, Leeds  
 Marshall, John. . . . Eden Lodge, Beckenham, S. E.  
 Marshall, T. Bumpstead. . . . Branstons, Lincoln  
 Marshall, Wm. . . . Bolney Place, Cuckfield,  
 Marsham, R., D. C. L. . . . Merton College, Oxford  
 Marson, W. . . . Acton Trussell, Penkridge  
 Marten, Peter. . . . Chilham, Canterbury  
 Martin, Chas. W., M. P. . . . Leeds Castle, Maidstone  
 Martin, David. . . . Wainfleet, Lincolnshire  
 Martin, E. Hall, jun. . . . Barr Hill, Madeley, Staffs.  
 †Martin, E. Waterer. . . . Nonsuch Park Farm, Ewell  
 †Martin, Fran. P. B. . . . Oxford & Cambridge Cl., S. W.  
 †Martin, Gilson. . . . Thorney, Peterborough  
 Martin, Henry B. . . . Colston Basset, Bingham, Notts  
 Martin, Robert. . . . Asterby, Horncastle  
 Martin, S. D. . . . 1, Park Place, Leeds  
 Martineau, R. . . . Walsham-le-Willows, Bury St. Edm.  
 †Masfen, R. Hanbury. . . . Pendeford, Wolverhampton  
 Mashiter, Thomas. . . . Priest's, Romford, E.  
 †Mason, C. A. . . . Tarrington, Ledbury, Herefordsh  
 Mason, Capt. Geo. . . . Manor House, Yateley, Hants  
 Mason, Matthew. . . . 9, Portland Place, Brighton  
 Mason, Richard. . . . Keddington, Louth  
 Mason, Col. Wm. . . . Necton Hall, Swaffham  
 Massey, Sampson. . . . Harkstone, Derby  
 Massey, Samuel. . . . Lawton Arms, Lawton, Cheshire  
 †Master, Charles H. . . . Barrow Green House, Godstone  
 Master, Col. Wm. C. . . . Knowle Park, Bristol  
 Master, Col. Thos. W. C. . . . The Abbey, Cirencester  
 Masterman, Thos. J. . . . Little Danby, Northallerton  
 Masterman, T. W. . . . The Hall, Rotherfield, Tun. Wells



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 Mather, Joseph...Newcastle-on-Tyne  
 Mather, William...Hemscott Hill, Morpeth  
 †Matheson, Sir J., Bt., M.P...The Lewes Island, N.B.  
 Mathew, Nath...Wern, Caernarvonshire  
 Mathews, Augustus...Pitchcombe, Stroud  
 †Mathews, Jeremiah...Edgbaston Ho., Birmingham  
 Mathews, William...The Leasowes, Birmingham  
 Maton, Leonard Pitt...Maddington, Devizes  
 Matson, William...St. Osyth, Colchester  
 †Matson, W. Bawtree...Kentish Blangs, Boro', S.E.  
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 Matthews, Frank...Glyn Moore, Isle of Man  
 Matthews, Francis Cook...Driffield  
 Matthews, Henry...Montford, Shrewsbury  
 Matthews, John, M.D...Tynemouth  
 Matthews, John...I, Cross Street, Whitehaven  
 †Matthews, Thomas...Sporle, Swaffham  
 Maud, Chas. T...Manor House, Bathampton, Bath  
 Maude, Wm. E...Holmscales, Milnthorpe  
 Maughan, Robert...Oxford St., Newc.-on-Tyne  
 Maunsell, Thomas P...Thorp Malsor, Kettering  
 Maw, H. Lister...Tetley, Crowle, Isle of Axholm  
 Maw, Mathew...Cleatham, Kirton-in-Lindsey  
 Mawson, John...Newcastle-on-Tyne  
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 Maxwell, Hon. M. Constable...Terregles, Dumfries  
 Maxwell, Wellwood...Munches, Dalbeattie, N.B.  
 May, Charles N...Devizes (North Wilts Foundry)  
 May, George Anderson...Elford Park, Lichfield  
 May, John...London Road, Reading  
 Mayall, John E...The Grove, Pinner, Watford  
 Maynard, Robert...Whittlesford, Cambridge  
 Mead, Wm. Rich...Ballymartle, Kinsale, Cork  
 Mechi, Alderman J. Jos...4, Leadenhall Street, E.C.  
 †Medlycott, Sir W. C., Bt...Milborne Port, Sherborne  
 Meeson, Wm. Taylor...Doggets, Rochford  
 Mein, William...Brewood, Staffordshire  
 Meir, Henry...Green Gates, Tunstall, Staffordshire  
 Meire, Sam...Castle Hill, Harley, Much Wenlock  
 Meire, Thos. Lockley...Cound Arbor, Shrewsbury  
 Mellard, James...Rugeley, Staffordshire  
 Mello, William...Chadwell, Ware  
 Mellows, William...High Melton, Doncaster  
 Melville, Hon. A. Leslie...Branston Hall, Lincoln  
 †Melville, Alex. S. Leslie...Branston Rectory, Linc.  
 †Melville, Charles Leslie...Branston Hall, Lincoln  
 Melvin, James...Bonnington, Ratho, Edinburgh  
 Mercer, F...28, Clayton St. West, Newc.-on-Tyne  
 †Mercer, James, M.D...  
 †Mercer, William...Newton, Warrington  
 Mercer, William...Grove Ho., Hunton, Staplehurst  
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 †Merriman, Thomas Baverstock...Marlborough  
 †Merriman, Wm. Clark...Lockeridge, Marlborough  
 Merson, Jas...Brinsworthy, North Molton, Devon  
 †Mertens, Baron Edward...Rue Ducale, Brussels  
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 †Methley, W...24, Soho Square, W.  
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 †Meyer, James...Forty Hall, Enfield, N.  
 †Meyer, P. Herman...Stondor Place, Brentwood

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 Michell, John...Forecott Park, Darlington  
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 Middleton, Saville...Water Newton, Hunts  
 †Midgley, W. H...Bryntirion, Corwen, Merioneth.  
 Midworth, John...Newark-on-Trent  
 Milbank, Sussex...Barningham Park, Darlington  
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 Mildmay, Humphrey, M.P...Shoreham, Sevenoaks  
 †Miles, Charles W...Burton Hill, Malmsbury  
 †Miles, John Wm...King's Weston, Bristol  
 †Miles, Grosvenor...Bourton House, Rugby  
 †Miles, P. W. S...61, Queen's Square, Bristol  
 Miles, Roger Dutton...Keyham, Leicester  
 Miles, Thomas...Keyham, Leicester  
 †Miles, William...Dix's Field, Exeter  
 Miles, Wm. Marsh...Fragham, Nonington, Wingham  
 Milford, Thos...Thorverton, Culmington  
 †Miller, Bartlett...Moulton, Northampton  
 Miller, George...Barnstaple  
 Miller, George...Gateshead  
 Miller, G. Seymour...Bradpole, Bridport  
 Miller, Samuel...The Court, Abermule, Montgom.  
 Miller, Thomas...Pictree House, Fence Houses  
 Mills, John F...Westwell, Burford, Oxon  
 Mills, John...Bisterne, Ringwood  
 Mills, John...Pinkneys Green, Maidenhead  
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 Mills, R. W. F...Dunnington, York  
 †Mills, Wm...Saxham Hall, Bury St. Edmund's  
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 Milne, Oswald, jun...Woodville, Leamington  
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 Milnes, James...Alton Manor, Wirksworth, Derbys.  
 Milvain, Ed. D...14, Elswick Villas, Newc.-on-Tyne  
 Milward, Dawson A...Tullogher, New Ross  
 Milward, Richard...Thurgarton Priory, Southwell  
 Minet, Charles Wm...41, West Smithfield, E.C.  
 Minett, Junius E...Arley, Coventry  
 Minor, A. H...Astley House, Shrewsbury  
 Minor, John...Fern Hill, Market Drayton  
 Minton, Alfred...Windsor  
 Mitchell, Andrew...Alloa, Clackmannanshire, N.B.  
 Mitchell, John...Wymondham, Norfolk  
 Mitchell, J. Hoffer...Witchampton, Wimborne  
 †Mitford, Wm. Townley, M.P...Pitshill, Petworth  
 Moat, G. Thos...Northumberland St., Newc.-on-Tyne  
 Molyneux, James More...Losely Park, Guildford  
 Monck, J. Bligh...Coley Park, Reading  
 Monckton, E...Hale Place, East Peckham, Tunbridge  
 †Monckton, E. H. C...Fineshade Abbey, Northamp.  
 Monins, John...Ringwood, Dover  
 Monkhouse, Fred, Thos...Dorney Lodge, Windsor  
 Monkhouse, John...The Stowe, Hereford  
 Monro, Mordaunt Martin...Enfield  
 Montagu, G. H...Caversham Hill, Reading  
 †Monteagle, Lord...Mount Trenchard, Limerick  
 Montgomerie, F. M...St. Leonard's Ho., St. Leonard's  
 Montgomery, Rev. R...Holcott Rectory, Northamp.  
 Moody, Col. R. C...Senior United Serv. Club, S.W.  
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Moore, Edward Wells...Coleshill, Faringdon  
 Moore, George...Appleby Hall, Atherstone  
 †Moore, Rev. G. Bridges...Tunstall, Sittingbourne  
 Moore, Henry...Elmsley Castle, Pershore  
 Moore, James...Monksbury Court, Ledbury  
 Moore, J. ...11, Upper Berkeley St., Portman Sq., W.  
 Moore, John...Kerry, Montgomery  
 Moore, John...Church Street, Warwick  
 Moore, John...Moor House, Badsworth, Pontefract  
 Moore, Joseph...Wollaton House, Nottingham  
 †Moore, Thos. William...Warham, Wells, Norfolk  
 Moore, Wm...Elm, Wisbeach  
 Moorsom, C. R...Darlington  
 Morant, George...Farnborough, Hants  
 Mordue, Francis...Wallsend, Newcastle-on-Tyne  
 Mordue, Joseph...Wallsend, Newcastle-on-Tyne  
 †Morgan, Maj. G. C., M.P...Rupera Castle, Cardiff  
 Morgan, Roger...Llanellen, Abergavenny  
 Morgan, John...Market Square, Shrewsbury  
 Morgan, M...North Bondgate, Bishop Auckland  
 Morgan, Thomas...Burnt House, Waltham Cross, N.  
 Morison, John Alex., M.D...Portclem, Pembroke  
 Morland, George Bowes...Abingdon  
 Morland, W. Courtenay...Court Lodge, Lamberhurst  
 †Morley, John...  
 Morley, John...Broughton Lodge, Manchester  
 Morley, John...Effingham Hill, Dorking  
 Morley, Robert...Birkbeck, Northallerton  
 Morley, William...Brize Norton, Faringdon  
 †Morrell, Frederick J...St. Giles's, Oxford  
 Morrell, James...Headington Hill, Oxford  
 Morrell, James Conyers...Leyland, Lancashire  
 †Morrice, J. W...The Tower, Calthorpe, Rugby  
 Morris, Abiathar...Pendeford, Wolverhampton  
 Morris, E. John...Stanley Pontlarge, Winchcombe  
 Morris, John...Town House, Madley, Hereford  
 Morris, John...Wightwick House, Wolverhampton  
 †Morris, Col. Lewis G...Morrisania, New York  
 †Morris, Norman...The Warren, Edenbridge  
 Morris, Philip S...Woodmanton, Worcester  
 Morris, Richard...Knockin Heath Farm, Oswestry  
 †Morris, Thos., jun...Walcote Fields, Lutterworth  
 Morris, Thomas...Maisemore, Gloucester  
 Morris, Walter...Dewsal Court, Hereford  
 Morris, William...Carmarthen  
 Morris, Wm. C...Whitwick, Lower Eagleton, Ledbury  
 Morris, Lieut.-Col. W. J...Heppington, Canterbury  
 Morris, W. Rudkin...North Luffenham, Leicester  
 †Morrison, Charles...Basildon Park, Reading  
 †Morrison, Frank...Hole Park, Tenterden  
 Morrison, R...Shieldfield House, Newcastle-on-Tyne  
 †Morrison, Walter, M.P...Malham Tarn, Skipton  
 Morris, N...Blue Ho., Washington Stat., Durham  
 Morrow, Hugh...Corabould House, Longford  
 Morse, Joseph Ramey...Lound, Lowestoft  
 Morshead, Sir Warwick, Bt...Forest Lodge, Binfield  
 Morton, Henry Thomas...Biddick, Fence Houses  
 Morton, Hugh...Leith, Edinburgh  
 Morton, John Chalmers...Streatham, Reading  
 †Morton, J. D...83, St. George's Road, S.W.  
 Moscrop, W. J...Kirkleatham, Redcar  
 Moseley, Henry...Westhide Court Farm, Hereford  
 Mosley, Sir O., Bt...Rolleston Hall, Burton-on-Trent

Mosley, Tonman...East Lodge, Burton-on-Trent  
 Moss, D. Topham...16, Camden Terrace, Leeds  
 Moss, Henry...Bentley Hill, Brentwood  
 Mostyn, Sir P., Bt...Tallacre, Holywell, Flintshire  
 †Mott, Charles John...Lichfield  
 Mott, Thomas...Much Hadham, Ware  
 Mott, William...Wall, Lichfield  
 Mould, Wm...Knowsley, Prescott, Lancashire  
 Mount Edgumbe, Earl of...Mt. Edgumbe, Cornwall  
 Mount, Thomas...Saltwood, Hythe  
 Mount, William...Wasing Place, Reading  
 Mourant, Edward...Samare's Manor, Jersey  
 Mousley, Geo...Hooton Hall, Chester  
 Moxon, William...3, St. Martin's Place, W.C.  
 †Moysey, H. G...Batheaton Court, Wiveliscombe  
 Muckle, Robert...Cresswell, Morpeth  
 †Muggeridge, Sir Henry, Kt...Ashurst, Dorking  
 Mulken, Edmund Cowell...Leighfield, Ockley  
 Mulliner, Job...Royton Farm, Wrexham  
 Mumford, George S...Lavenham, Sudbury  
 †Mumford, Maurice...Creting, Stowmarket  
 Mumford, Richard...Chilton Park Farm, Thame  
 Mumford, William...Crendenhill, Hereford  
 †Mumford, William Henry...  
 Mundy, William...Markeaton, Derby  
 †Munn, Fred...Temple Laugham, Worcester  
 †Munn, Maj. W. A...Throwley House, Faversham  
 Murdoch, James Gordon...1, Pall Mall East, S.W.  
 †Murray, Alex...Worlington Hall  
 Murton, Frederick...Smeeth, Ashford  
 Murton, Walter...East Stour, Ashford  
 Murton, William...Tunstall, Sittingbourne  
 Musgrave, John...Pocklington  
 Musgrave, Simeon...Market Weighton, Yorkshire  
 †Musgrave, Sir Geo., Bart...Edenhall, Penrith  
 Musgrave, Rev. Vernon...Hascombe, Godalming  
 Muskett, Chas...Bressingham House, Diss  
 Muspratt, S., M.D...Royal Coll. Chemistry, Liverpool  
 Myers, Christopher...Dunston, Gateshead  
 †Mynors, R...Weather Oak, Alvechurch, Bromsgrove  
 Myott, James...Copesthorne, Congleton  
 Myott, Richard...Lower Overton, Congleton  
 Mytton, Thos...Shipton Hall, Much Wenlock

## N.

Nainby, Charles M...Barnoldby, Grimsby  
 Nainby, Richard...Barnoldby, Grimsby  
 †Naish, W. B...Stoneaston, Bath  
 Naper, Jas. L., jun...Lougherew, Oldcastle, Ireland  
 †Napier, Edw. B...Pennard House, Shepton Mallet  
 Napier, Hon. William...2, Old Palace Yard, S.W.  
 Napper, John...Ifold, Horsham  
 Nash, Charles...Royston  
 Nash, Daniel...4, York Gate, Regent's Park, N.W.  
 Nash, John...Reed-court, Rochester  
 †Nathusius, Baron...Hundsburg  
 †Naylor, John...Liverpool  
 †Naylor, Rich. Christopher...Hooton Hall, Chester  
 Neale, Charles...Mansfield Woodhouse, Notts  
 Neale, Charles...New Field, Newark

Neale, Charles James... Mansfield, Notts  
 Neame, Charles... Woodlands, Selling, Faversham  
 †Neame, Edward... Selling Court, Faversham  
 Neame, Frederick... Macknade, Faversham  
 Neame, Percy B... Swanton Lodge, Lydden, Dover  
 Neate, John Reeks... Northington Farm, Overton  
 Neave, Sir Digby, Bart... Dagenham Pk., Romford, E.  
 Neave, Sheffield... Oakhill House, Hampstead, N.W.  
 Needham, F. Haywood... Fearnall Heath Ho., Worc.  
 Needham, W. B... Fearnall Heath Ho., Worcester  
 †Negus, Thomas A... Lynn House, Walsall  
 †Neild, Wm... Mayfield, Manchester  
 Neilson, Thomas... Regent Terrace, Gateshead  
 Nelmes, William... Pembridge Castle, Monmouth  
 Nelson, Wm. M... Cardigan Place, Leeds  
 Nesham, David... Houghton-le-Skerne, Darlington  
 Nesfield, R. M. N... Castle Hill, Bakewell  
 Nethercoat, John... Moulton Grange, Northampton  
 Neve, Charles... Shepway Court, Maidstone  
 Neve, George... Sissinghurst, Staplehurst  
 Neve, Thomas... Benenden, Staplehurst  
 Nevett, Wm... Yorton Villa, Harmer Hill, Salop  
 †Nevile, Rev. Christopher... Thorney, Newark, Notts  
 †Nevile, George... Shepton, Newark-on-Trent  
 †Nevill, Viscount... Hope Hall, Tadcaster  
 Nevill, Thos... Montford, Shrewsbury  
 Neville, Samuel... Newcastle-on-Tyne  
 New, David... Waverley House, Nottingham  
 New, Richard... Hartpury, Gloucester  
 Newall, Mary... Fern Dean, Gateshead  
 Newall, R. S... Fern Dean, Gateshead  
 Newall, Wm... Fern Dean, Gateshead  
 †Newbery, Rich. Phelps... Challenger, Axminster  
 Newcastle, Duke of... 20, Portman Square, W.  
 Newcombe, Fred... Ravensworth, Gateshead  
 Newdegate, C. N... Arbury, Coventry  
 †Newdigate, F.W., M.P... Byrkley Lge., Burton-on-Tt  
 Newill, Joseph... Walcot, Lydbury, Shropshire  
 Newill, Thos... Spring Bank, Welshpool  
 Newill, Thos., jun... Montford, Shrewsbury  
 †Newman, J... Brands Ho., High Wycombe, Bucks  
 Newman, Thomas... Lyn Court, Mamhead, Exeter  
 Newman, Thomas... Cray's Marsh Farm, Melksham  
 Newport, Viscount... 30, Wilton Crescent, S.W.  
 Newsome, W....  
 Newton, Chas. Ed... Mickleover, Derby  
 †Newton, G. Onslow... Croxton Park, St. Neot's  
 Newton, John... Grove Lodge, York  
 Newton, John... Chollerton, Hexham  
 Newton, Joseph... 3, Melbourne St., Gateshead  
 †Newton, R. J... Campfield, Woodstock  
 †Newton, Thomas... The Cedars, Mitcham Cmmn., S.  
 Newton, Thos. H. G... Barrell's Park, Birmingham  
 Nicholay, J. A... Cumberland Mills, Isle of Dogs, E.  
 Nicholls, John S... Buckland, Lymington  
 Nicholls, Lambert... Howsen, Cotheridge, Worcester  
 Nicholls, Wm... Chippenham  
 Nichols, Ben... West End Farm, Aldershot  
 Nichols, George... Spa Gardens, Leicester  
 Nicholson, Brady... Stourton Grange, Leeds  
 Nicholson, Charles... Staniwells, Brigg  
 Nicholson, Geo... Winlaton, Blaydon-on-Tyne  
 †Nicholson, James... Blencairn Hall, Penrith

Nicholson, J... Kirkby Thore Hall, Westmoreland  
 Nicholson, John... Barford St. Martin, Salisbury  
 Nicholson, Capt. S... Waverley Abbey, Farnham  
 †Nicholson, William... 4, Sussex-square, W.  
 Nicholson, Wm. Newzam... Newark-upon-Trent  
 Nickisson, John... Stone, Staffordshire  
 Nicks, John... Leek Wootton, Warwick  
 Nicol, James Dyce... 5, Hyde-Park Terrace, W.  
 †Nightingale, Vaughan E... Burway, Ludlow  
 †Nightingale, W. E... Embley, Romsey  
 Nisbet, Ralph P... Row Wood, Chalfont St. Giles  
 Nixon, William... Union Hall, Newcastle-on-Tyne  
 †Noakes, John Tompsett... Brockley Ho., Lewisham  
 Nock, Thomas... Sutton Maddock, Shifnal  
 Nodder, Rev. J... Ashover Rectory, Chesterfield  
 Noel, Eugène F... 36, Westbourne Terrace W.  
 †Norman, George Warde... Bromley, Kent, S.E.  
 †Norman, J. Newcomb... Harborough Magna, Rugby  
 Norreys, Robt. H... Davy Hulme Hall, Manchester  
 Norrington, Charles... Cattedown, Plymouth  
 Norris, Rev. G. P... Roseraddoc House, Liskeard  
 †Norris, Wm... Wood Norton, Fakenham  
 North, Chas... South Thoresby, Alford, Lincolnsh  
 North, Frederick... Rougham, Norfolk  
 North, Lieut.-Col... Wroxton Abbey, Banbury  
 †Northcote, Sir Stafford, Bt., M.P... Pynes, Exeter  
 Northey, Edward Richard... Epsom  
 Northey, Wm... Lake, Lifton, Devon  
 Norton, W. F. Norton... Elton Manor, Nottingham  
 Noton, John... Edenscro, Chesterfield  
 †Nott, James... Penn, Amersham, Bucks  
 †Nottidge, Josias... Ramsgate  
 Nowell, W. A... Netherside, Skipton, Yorkshire  
 Noyes, Thomas H... Borde Hill, Cuckfield

O.

Oakes, Hervey Asten... Stowmarket  
 Oakes, Thos. Haden... Riddings House, Alfreton  
 Oakley, James... Wilford, Nottingham  
 Oakley, John... 10, Waterloo Place, S.W.  
 Oakley, Richard... Lawrence End, Luton  
 O'Brien, Stafford... Blatherwycke Park, Wansford  
 †Ockleston, Wm. Fairhurst... Ingon, Strat.-on-Avon  
 Odams, James... 109, Fenchurch Street, E.C.  
 Oddie, Walter... Pink's Farm, Shenley, Barnet  
 †Ogden, John Maude... Sunderland  
 Ogilvy, Sir J., Bt... Baldovan House, Dundee, N.B.  
 Ogle, Charles... Rawcliffe Bridge, Selby  
 Oldacres, Matthew... Clipston, Market Harborough  
 Oldacres, Walter... Broad Fields, Lichfield  
 Oldham, John... Carlton-on-Trent, Notts  
 Olding, Edmund... Rasfin Farm, Amesbury  
 Oldrin, John... Rushmere, Wangford, Suffolk  
 Oliver, James... Hanford, Blandford  
 †Oliver, John... Oxendon, Northampton  
 Oliver, Robert... Sholbrooke Lodge, Towcester  
 Oliver, Robert John... Docking, Lynn  
 †Olorenshaw, Joseph... Hatton Grange, Warwick  
 Onslow, Arthur P... Send Grove, Ripley, Surrey  
 Onslow, Major P... Dunsbrough Ho., Ripley, Surrey  
 Ord, Rev. J. A. B... Whitfield Hall, Haydon Bridge



Ord, James... Cloth Market, Newcastle-on-Tyne  
 Orde, Charles William... Nunnykirk, Morpeth  
 †Orde, Sir J. P. W., Bt... Kilmorey Ho., Loch Gilp Head  
 Orlebar, R. L... Hinwicke House, Wellingborough  
 Ormerod, George... Sedbury Park, Chepstow  
 Ormerod, Henry Mere... 5, Clarence St., Manchester  
 Ormond, Francis... Blyth, Workop  
 Ormston, Robert... Newcastle-on-Tyne  
 Orton, Francis... Bottisford, Nottingham  
 †Osborn, G., jun... Manor Ho., Pattishall, Towcester  
 Osborn, Henry... Weeford Park, Hints, Tamworth  
 Osborne, Geo... Court Farm, Elberton, Bristol  
 Ostler, John, jun... Walrod Park, Taunton  
 Other, Christopher... Elm House, Leyburn, Yorks.  
 †Otrante, Count A... Nygard, Söderköping, Sweden  
 †Overman, Henry R... Weasenhams, Fakenham  
 †Overman, John... Burnham, Sutton, Norfolk  
 †Overman, Robert... Egmore, Walsingham, Norfolk  
 Owen, B. H. Bulkeley... Tedsmore Hall, Salop  
 Owen, Richard... Houghton, Tarporley  
 Owen, Thomas... The Hague, Chesterfield  
 Owen, William... Blessington, Ireland  
 Owen, William... Moorgate Hall, Rotherham  
 Owen, William... Newcastle-on-Tyne  
 Owen, William... Withybush, Haverfordwest  
 Owens, Samuel... Whitefriars Street, E.C.  
 Owsley, Wm. P. Mason... Blaston, Uppingham  
 Oxford, Bishop of... Cuddesden, Wheatley, Oxon

## P.

Pace, Edward Henry... Pershore  
 Pack, Thomas Henry... Ditton, Maidstone  
 †Packard, Edward... Ipswich  
 †Packer, Rev. A... Walton Rectory, Loughborough  
 †Packer, Geo. H... Caythorpe Hall, Grantham  
 †Packer, Dr. James... Melton Lodge, Woodbridge  
 Paddock, Henry... The Trench, Ellesmere  
 Padmore, Richard, M.P... Worcester  
 Paddick, Fred... West Thorney, Emsworth, Hants  
 Page, Bridgewater... West Cliff, Southampton  
 Page, Edward... Bedford  
 Page, Henry Robert... Beckenham Place, S.E.  
 †Page, Henry... Walmer Court, Walmer  
 Page, Thomas... Tower Cressy, Campden Hill, W.  
 Page, William, jun... Southminster, Maldon  
 Paget, C., M.P... Ruddington Grange, Nottingham  
 Paget, E. Arthur... Thorpe, Leicester  
 Paget, Lewis... Quenibro', Leicester  
 †Paget, T. Tertius... Humberstone, Leicestershire  
 Pain, John... Popham, Micheldever Station  
 Pain, Philip... Boughton House, Kettering  
 Pain, Thomas... Laverstock Hall, Salisbury  
 †Paine, Mrs... Farnham, Surrey  
 †Paine, Wm. Dunkley... Cockshutt Hill, Reigate  
 Painter, John... Forest Road, Nottingham  
 Painter, Thomas... Bodlondeb, Wrexham  
 Paitson, William... Irish Street, Whitehaven  
 Pakington, Rt. Hon. Sir John, Bt., M.P... Droitwich  
 †Palin, William... Stapleford Hall, Chester  
 Palmer, A. S... Willington, Newcastle-on-Tyne  
 Palmer, C. M... Whitley Park, Newcastle-on-Tyne

†Palmer, Sir Geo. J., Bart... Wanlip Hall, Leicester  
 Palmer, George... Greenwood, Bishop's Waltham  
 Palmer, Sir J. H., Bt... Carlton Park, Rockingham  
 †Palmer, Rev. P. H... Wolsthorpe Rectory, Grantham  
 Palmer, Robert... Bexington, Bridport  
 Palmer, Thos... Stoke Chingland, Callington  
 Palmer, Walter James... Pencoyd Court, Ross  
 †Palmerston, Visc., M.P., K.G... Broadlands, Romsey  
 Papendick, Bridget Ann... Glasbury Ho., Hay, S.W.  
 †Papillon, P.O., M.P... Manor Ho., Lexden, Colchester  
 Papillon, Thomas... Crowhurst Park, Battle  
 Paramore, J. Rawle... Dinedor Court, Hereford  
 Parker, Charles L... Ilderton, Alnwick  
 †Parker, Charles Stuart... Annesley, Liverpool  
 Parker, F. Sumner... Oxtun, Southwell  
 Parker, Rev. Henry... Ilderton, Alnwick  
 Parker, Henry... Low Elswick, Newcastle-on-Tyne  
 Parker, J. O... Woodham Mortimer, Maldon, Essex  
 Parker, K. S., Q.C... Examiner's Office, Rolls Yd., W.C.  
 Parker, Capt. R. L... Low Elswick, Newcastle-on-T.  
 Parker, Rowland... Moss End, Burton, Westmoreland  
 Parker, Thomas James... 10, George St., Sheffield  
 †Parker, Wm... Carlton Hill, Penrith  
 Parker, William... The Park, Ware  
 Parker, Maj. W., M.P... Clopton Hall, Suffolk  
 Parker, Rev. W... Rectory, Little Comberton, Pershore  
 Parker, Rev. W. H... Saham Rectory, Watton, Norf.  
 Parker, W. H... Newcastle-on-Tyne  
 Parkes, T... Warridge Ldg., Grafton Manor, Bromsgr.  
 Parkin, John... Idrigehay, Wirksworth  
 †Parkinson, J., jun... Ironmonger Lane, E.C.  
 †Parkinson, R... Dutton Ldg. Preston Brook, Chester  
 †Parkinson, Thomas... Hexgreave Park, Southwell  
 Parkinson, Wilfrid... Ann's Hill, Cockermouth  
 †Parkyns, Sir Thos. G. A., Bt... Ruddington, Notts.  
 Parland, John... Stotes Hall, Newcastle-on-Tyne  
 Parnell, John... Rugby  
 Parnell, Wm... 21, Collingwood St., Newcastle-on-T.  
 Parr, Samuel... The Poultry, Nottingham  
 Parrington, John... Brancepeth, Durham  
 †Parris, John W... Farnham, Bishop's Stortford  
 Parrott, Thos... Green Bank, Sutton, Macclesfield  
 Parry, Edward Powell... Morfodion, Llandiloies  
 †Parry, Joseph, jun... Allington, Devoes  
 Parry, Nicholas... Little Hadham, Ware  
 Parson, Rev. W. H... Lynchmere Rectory, Haslemere  
 Parson, Wm... Rivers Hall, Boxted, Colchester  
 Parsons, C., jun... N. Shoebury Hall, Rochford, Essex  
 Parsons, Charles William... Anstrey, Atherstone  
 †Parsons, Geo... Martock, Somerset  
 †Parsons, Henry... Haselbury, Crewkerne  
 Parsons, John... Oxford  
 Parton, John... Chorlton, Nantwich  
 Partridge, John... Bishop's Wood, Ross  
 †Paterson, Geo... Poyle House, Colnbrook, Bucks  
 †Paterson, Richard... Leesons, Chiselmhurst  
 †Pateshall, Evan... Hereford  
 Pattenson, Capt. W. H. T... Ibornden, Biddenden  
 Patterson, John... Hall Beck, Ulverston  
 †Patterson, W. J... Durnford Ldg., Wimbledon, S.W.  
 Pattinson, H. L... Scots House, Newcastle-on-Tyne  
 Pattison, J. M... Norwood, Gateshead  
 Pattison, Thomas... Newcastle-on-Tyne



Pattison, T., jun....Newcastle-on-Tyne  
 Paul, Wm. Joseph...Piddletown, Dorchester 1  
 Paver, William...Peckfield, Milford Junction  
 Pawlett, Thos. Edward...Beeston, Sandy, Beds  
 †Paxton, Sir Joseph, Bt., M.P....Chatsworth, Bakewell  
 Paxton, Robert...Lower Winchenden, Aylesbury  
 Payne, Charles...Newcastle-on-Tyne  
 Payne, Henry...Birdbrook, Halstead, Essex  
 Payne, William...Willcott, Nesscliff, Salop  
 Peachey, Wm....Ebernoe, Petworth  
 Peacock, Wilkinson...Greatford Hall, Stamford  
 †Peacock, Warren...Elford, Lymington  
 †Peacocke, G. M., M.P....33, Hertford St., W.  
 Pearce, George...Walcot, Pershore  
 Pearce, Col. Wm....Fauconberg House, Cheltenham  
 Pears, William...Fenham Hall, Newcastle-on-Tyne  
 †Pearse, Henry...32, Queen's Gate Terrace, W.  
 Pearson, T.. 22, Eldon Street, Newcastle-on-Tyne  
 †Pease, Joseph Whitwell...Woodlands, Darlington  
 †Peck, Edmund...Plas-y-Dinas, Shrewsbury  
 Peel, Edmund...Bryn-y-Pys, Wrexham  
 Peel, George...Brookfield, Cheadle, Manchester  
 Peel, John...Middleton Hall, Fazeley  
 †Peel, Jonathan...Knowlmere Manor, Clitheroe  
 Peel, Sir R., Bart., M.P....Drayton Manor, Fazeley  
 Peel, Wm....Taliaris Pk., Llandilo, Carmarthenshire  
 Peel, William...Trenant Park, Looe, Cornwall  
 Peel, Xavier...Denant, Haverfordwest  
 Peele, Henry...17, Princess St., W. Hartlepool  
 Peers, Joseph...Ruthin  
 Peile, George, jun....Greenwood, Shotley Bridge  
 †Peile, Thos. Williamson...Tullihinel, Kerry  
 Peirson, John...24, Micklegate, York  
 Pelegrin, Mrs....Newcastle-on-Tyne  
 Pelegrin, Manuel José...Newcastle-on-Tyne  
 Pelham, Francis...Norfolk Farm, Windsor Park  
 †Pell, Albert...Hazelbeach, Northampton  
 †Pell, Sir Watkin O., Bt....Greenwich, S.E.  
 Pelly, Sir John H., Bt....Warnham Court, Horsham  
 Pelly, Capt. R. Wilson...The Willows, Upton, E.  
 †Pemberton, Rev. R. N....Church Stretton, Salop  
 †Penn, Granville J....  
 †Pennant, P. P....Brynbella, St. Asaph  
 Pennell, H. B....Dawlish  
 Pennington, Richard...Westfield House, Rugby  
 Penrice, Thomas...Kilvrough, Swansea  
 †Peploe, Capt. Daniel Peploe...Garston, Hereford  
 Pepper, John...3, Queen Street, Leeds  
 Pepper, William...Clarendon Mount, Leeds  
 Peppercorne, H....Bradburn Pk., East Malling  
 †Perales, Marquis de...Madrid  
 †Perceval, Chas....West Haddon, Northamptonshire  
 Percival, Ralph H....Tetton Hall, Middlewich  
 Peren, W. B....Compton, South Petherton, Somerset  
 Perkins, C. F....The Grange, Kingston, Taunton  
 †Perkins, Henry...Thriplow Place, Royston  
 Perkins, John S....Leek Wootton, Warwick  
 Perkins, Jos., jn....Laughton, Theddingworth, Rugby  
 †Perkins, Thomas...Hitchin  
 †Perry, Thos. A....Betham Ho., Avon Dasset, Banbury  
 Perry, Sir T. E., Bt., M.P....West Court, Berkshire  
 Perry, William...Cholstrey, Leominster  
 Perry, Wm....Alder Lewdown, Exeter

Perry, William J....King's Somborne, Stockbridge  
 †Perry-Watlington, J. W., M.P....Moor Hl., Harlow  
 Pertwee, J. F....Rattendon, Wickford, Essex  
 Peters, Daniel...31, College Green, Bristol  
 †Peto, Sir S. M., Bt., M.P....9, Gt. George St., S.W.  
 Phelps, Charles...Briggs Park, Ware  
 †Philips, Sir G. R., Bart....Shipston-on-Stour  
 Phillips, Mark...Snitterfield, Stratford-on-Avon  
 Philpison, John...Newcastle-on-Tyne  
 Philipson, L. W....15, Pilgrim St., Newcastle-on-T.  
 Phillimore, Edward...Cheltenham  
 Phillimore, Rev. G....Radnage, Stokenchurch, Oxon  
 Phillips, James...Bryngwyn, Ross, Herefordshire  
 †Phillips, Robt. Biddulph...Longworth, Hereford  
 Phillips, Wm....The Lodge, Reigate  
 Phillips, Henry R....Willesden, Paddocks, Kilburn  
 Phillips, J. B....Brockton Leasows, Newport, Salop  
 Phillips, J. B. Lort...Penty Park, Haverfordwest  
 Phillips, Rev. John...Ludlow, Salop  
 †Phillips, J. H....Bradburne Grange, Nawton, York  
 Phillips, J. R. S....Riffhams, Chelmsford  
 Phillips, Joseph Taylor...Sheriff Haies Manor, Salop  
 Phillips, Richard...Brockton Grange, Shifnal  
 Phillips, Sir Thos., Knt....Llanellan, Abergavenny  
 Phillips, Maj.-Gen. Sir T., Knt...Sen. U. S. Cl., S.W.  
 Phillips, Thomas E....37, Wilton Place, S.W.  
 Phillpott, Harvey...Weston Ldg., Thames Ditt., S.W.  
 †Phillpotts, T., jun....Risca, Newport, Monmouthsh.  
 †Phipps, C. Paul...Chalcot House, Westbury  
 Phipps, Christopher...River, Dover  
 †Phipps, John Lewis...Leighton, Westbury, Wilts  
 Phipps, Thomas...Bricklehampston, Pershore  
 Pickering, Leonard...Wilcot, Charlbury, Oxon  
 Pickernell, John...Holt Castle, Worcester  
 †Pickford, William...148½, Fenchurch Street, E.C.  
 Pickin, W. C....Dunham, Notts  
 Pickin, Wm. John...Whitemore, Ollerton, Notts  
 †Piercy, Alfred...Cold Harbour, Henley, Oxon  
 †Pierson, Jas. Alex....The Gwynd, Arbroath, N.B.  
 Piggott, Jas. Algernon...Beckingham Hall, Witham  
 †Piggott, Geo. G....Doddershall, Winslow  
 Piggott, Simon Frazer...Fitzhall, Midhurst, Sussex  
 Pigot, Sir Robert, Bart....Patshill, Wolverhampton  
 Pike, Aaron...Mitton Farm, Tewkesbury  
 Pike, James...Reading  
 Pike, William...Castle Thorp, Stony Stratford  
 Pilbeam, Thomas...Henham, Wangford  
 Pilcher, Jesse...Cheriton Court, Hythe, Kent  
 Pilgrim, Charles H....  
 Pilgrim, S. C....Manor House, Burbage, Hinckley  
 †Pilkington, Sir L. M. S., Bart...Wakefield  
 Pinckhard, George H....Combe Court, Godalming  
 Pinder, Thomas...Barroby, Grantham  
 †Pinnegar, C....Rockbourn, Fordingbridge, Hants  
 Pinney, Col. W., M.P....Somerton-Erleigh, Somers.  
 †Pipon, Capt. M....Deerswood, Crawley  
 Pippet, William...Caughton House, Bromsgrove  
 Pitfield, A. J....Eype, Symondsburys, Bridport  
 Pitman, James S....Dunchideock House, Exeter  
 Pitt, George...Chadron Court, Dilwyn, Leominster  
 Pitt, Walter William...Whitchurch, Monmouth  
 Plaistow, Richard...13, Nixon St. Newcastle-on-T.  
 Plant, John...Model Mill, Sheffield

- Plant, Thomas...Elworth Hall, Sandbach, Cheshire  
 Platt, Henry...Werneth Park, Oldham  
 Platt, James...Newton, Malpas  
 Plowden, W....Plowden Hall, Bishop's Castle, Salop  
 Plowman, Joseph...Oxford  
 Plumble, John...Ashton Keynes, Cricklade  
 Plumpton, J. B....Goodnestone Farm, Wingham  
 Plumtre, Charles J....Pedding House, Sandwich  
 †Pocock, Chas....  
 Pocock, George...Redbourn Bury, Redbourn  
 Pocock, W. J. M....Wonston Manor, Micheldever Stat.  
 Pole, H. Chandos...Barton Fields, Derby  
 Pole, Sir Peter Van Notten, Bt....6, Up. Harley St., W.  
 Pole, Rev. Reginald Chandos...Radbourne, Derby  
 Pollard, George...Dilstone, Corbridge  
 Pollard, Henry...12, Ellison Pl., Newcastle-on-Tyne  
 †Pollard, Joseph...Highdown, Hitchin  
 Pollard, Joseph...12, Ellison Pl., Newcastle-on-Tyne  
 Pollard, Mrs....Newcastle-on-Tyne  
 †Pollen, R. H....Radbourne, Chippenham  
 Pollock, George D....27, Grosvenor Street, W.  
 Pollock, J. O. G....Mountain's Town, Navan, Ireland  
 †Polwarth, Lord...Mertown Ho. St. Boswell's, N.B.  
 Pomfret, Earl of...Easton Hall, Towcester  
 †Pomfret, Virgil...Tenterden, Kent  
 Ponsford, W. C....Trinity Chambers, Newcastle-on-T.  
 Poole, Domville...Marbury, Whitchurch, Shropshire  
 Pooley, Thomas...North Wold, Norfolk  
 Pope, Edward...Great Toller, Maiden Newton  
 Pope, John...Symondsby, Bridport  
 Pope, J. Raymond...Shipridge Farm, Mitcheldean  
 Pope, Thomas...Harewood, Bletchingly, Surrey  
 Pope, William...Biggleswade  
 Porcher, Charles...Cliffe, Dorchester  
 Portal, M....Laverstoke House, Micheldever Station  
 Porter, James...Corney Bury, Buntingford  
 Porter, J. T. B....Lincoln  
 Porter, Maj.-Gen....Minterne House, Dorchester  
 Porter, Thos....Bawton, Cirencester  
 Porter, Wm....Hembury Fort, Honiton  
 †Portman, Hon. W. H. B., M.P....Bryanston, Blandf.  
 †Portsmouth, Earl of...Eggesford Ho., North Devon  
 Postlethwaite, Thomas...Odfley Hotes, Hitchin  
 Potter, Addison...Heaton Hall, Newcastle-on-Tyne  
 Potter, John...Basinghall Street, Leeds  
 Potter, T. B....Bush Hill, Manchester  
 Potts, B....Calverton, Nottingham  
 Potts, John...Gateshead  
 Potts, John D....Woodboro', Nottingham  
 Powell, Alfred...Avenue House, Worcester  
 Powell, Evan...Newtown, Montgom.  
 Powell, George...8, Beaufort Buildings, Strand, W.C.  
 Powell, John...Watton Mount, Brecon  
 Powell, John Thomas...Easton, Pewsey, Wilts  
 Powell, J. Folliot...7, Albion Place, Hyde Park, W.  
 Powell, Richard...Benson, Oxon  
 †Powell, Rev. S. H....Sharon Hall, Ripon  
 †Powell, Thos. H....Drinkstone Pk., Woolpit, Suffolk  
 †Powell, T., jun....Coldra, Newport, Monmouthsh.  
 Powell, Wm....Eglwgs Nunydd, Taibach, Glamorg.  
 Powell, Wm....Tickford Abbey, Newport Pagnell  
 †Power, K. Manley...Hill Court, Ross, Herefordshire  
 Powis, Benjamin...Newnham, Tenbury  
 †Powlett, Lord William...Downham Hall, Brandon  
 Powys-Lybbe, Philip L., M.P....Hardwick, Reading  
 †Poynder, T. H. A....Hartham Park, Corsham  
 Prance, Courtenay Connell...The Elms, Evesham  
 Pratt, Edward...Caldwell, Burton-on-Trent  
 Pratt, Rich. Fred...Gt. Sanders, Sedlescomb, Battle  
 Preece, John...Cressage, Salop  
 †Prentice, Manning...Stowmarket  
 Prescott, Williams...Clarence, Roehampton, S.W.  
 †Preston, Capt. J. N....Flasby Hl., Gargrave-in-Craven  
 Preston, Thomas...Scosthrop Ho., Bell-Busk, Leeds  
 †Prettyman, Arthur...Camp Hill, Nuneaton  
 Price, Charles...Quenington, Fairford  
 Price, James...Eye Cottage, Leominster  
 Price, Richard G., M.P....Norton Manor, Presteign  
 Price, Thomas...Quenington, Fairford  
 Price, William...Glan Twrch, Swansea Valley  
 Price, Wm. Philip...Tiberton Ct., Gloucester  
 Prichard, C. H....Westown Ho., Brislington, Bristol  
 Prichard, Thos....Dderw, Rhayader, Radnorshire  
 Friday, Samuel...Linton, Gloucester  
 Pride, William...Lanvihangel, Chepstow  
 Prideaux, Sir Edm. S., Bart....Netherton, Honiton  
 Priest, Alfred...Kingston-on-Thames, S.W.  
 Priestley, J....Hirdrefaig, Bangor, Isle of Anglesea  
 Priestley, S. O....Trefan, Pwllheli, Carnarvonshire  
 Prince, William...Newton, Tamworth  
 †Pritchard, John...Broseley, Salop  
 Pritchard, Robt....Llwydiarth Esgob, Bangor  
 Pritchard Wm...3, Albert St., Camden Road, N.W.  
 †Probyn, Edmund...Huntley, Gloucestershire  
 Proctor, M....Killingwold, Newcastle-on-Tyne  
 Proctor, Thomas...Elmdale House, Clifton, Bristol  
 †Prodgers, Herbert...Kingston House, Chippenham  
 Pronger, James...Beeding, Horsham  
 Prosser, B....Offerton Farm, Hindlip, Worcester  
 Prosser, John...Holme Lacy, Hereford  
 †Prosser, Francis Wegg...Belmont, Hereford  
 Prosser, T....38, Cumberland Row, Newcastle-on-T.  
 Prout, John...Sawbridgeworth, Herts  
 Pryke, John P....Aldersfield Hall, Wickhambrook  
 Pryor, Morris...Baldock, Herts  
 Pryse, John Pugh...Bwlchbychan, Lampeter, S.W.  
 †Pryse, Capt., M.P....Gogerddan, Aberystwith  
 †Pryse, Pryse...Gogerddan, Bowskeet, Shrewsbury  
 Puckle, T. Broadhurst...Woodcote Grove, Carshalton  
 Pugh, David, M.P....Llanerchydol, Welshpool  
 Pugh, Robert...Llwyndû Lleyngwrl, Dolgelly  
 †Pugh, William...Coal Port, Ironbridge, Salop  
 Puleston, Rev. T....Worthernbury Rectory, Wrexham  
 †Pulleine, James...Crakehall, Bedale  
 Pullen, William...Worcester  
 Pullin, James...Wraysbury, Staines  
 Pullin, Stephen...Mildridge Farm, Horton, Slough  
 Pulteney, J. G. B....Portslade House, Shoreham  
 †Punnett, P. Simpson...Chart Sutton, Staplehurst  
 Puncard, Charles...Blunt's Hall, Haverhill, Suffolk  
 Purrott, Charles...High Street, Croydon, S.  
 Pursell, Samuel...Oxley, Wolverhampton  
 Purser, Edward...116, Fenchurch Street, E.C.  
 Purton, Wm....The Woodhouse, Cleobury-Mortimer  
 Purves, Peter...The Grove, Brampton, Huntingdon  
 †Pusey, S. E. Bouverie...Pusey House, Faringdon

Pyatt, Abraham... Wilford, Nottingham  
 †Pye, Geo... Cublington, Madley, Herefordshire  
 †Pye, Henry Abington... Louth, Lincolnshire  
 Pye Moses... North Shields

Q.

Quartly, Jas... Molland House, South Molton  
 Quartly, John... Champson Molland, South Molton  
 Quibell, William Oliver... Newark-on-Trent  
 Quinn, P... Agency, Poyntz Pass, Ireland

R.

Raester, William... Withington Court, Hereford  
 Radcliffe, Rev. Walter... Warleigh, Plymouth  
 Radford, H. B... Stanton Ho., Burton-on-Trent  
 Radford, William... Beeston, Nottingham  
 Raglan, Lord... Cefntilla Ho., Usk, Monmouthshire  
 Railton, Henry... Snittlegarth, Wigton  
 †Raincock, H. D... Croydon  
 Raine, William Surtees... Gainford, Darlington  
 Rainforth, Edward... Monkhopton, Bridgnorth  
 Ralph, R. W... Honnington Grange, Newport, Salop  
 Ralphs, John... Saughton, Chester  
 Ralston, James... Danesfield, Great Marlow  
 Ralston, Wm. Henry... Keele, Newcastle, Staffs.  
 Rammell, Thomas... Sturry Court, Canterbury  
 Ramsay, David R... Willington, Walsend  
 Ramsay, G. H... Derwent Villa, Newcastle-on-T.  
 Ramsay, John T... Walbottle Hall, Newcastle-on-T.  
 Ramsay, Thomas... Sherburn Green, Gateshead  
 Ramsbotham, J... Crowborough Warren, Tunb. Wells  
 †Ramsden, John Charles... Oxen Hall, Tadcaster  
 Ramsden, Robert... Carlton Hall, Worksop  
 Ramsey, John... 9, Endsleigh Street, W.C.  
 Rand, William... Saffron Walden  
 Randall, Alexander... Maidstone  
 Randall, R. G... Winfrith, Dorchester, Dorset  
 Randall, Charles... Chadbury, Evesham  
 Randell, James R... Chadbury, Evesham  
 Randle, Thomas... Ombersley, Droitwich  
 Randolph, Vice-Ad. C. G... Gt. Comp, Sevenoaks  
 Randolph, Lt.-Col. C. W... 5, Victoria Sq., S. W.  
 Ranford, Chas... 377, New Cross Road, S.E.  
 Ranger, Josiah... Ashdown Park, East Grinstead  
 Ranken, W. B... Abbott's Langley House, Herts  
 Rankin, John... Union Foundry, Liverpool  
 Ransome, Frederick... Ipswich  
 Ransome, James Allen... Ipswich  
 Ransome, J. E... Bolton Hill, Ipswich  
 Ransome, R. C... Bolton Hill, Ipswich  
 Ransome, Robert... Ipswich  
 Ratcliff, R... Standard Hill, Ninfeld, Battle  
 Ratleff, William... Newmarket  
 Ravensworth, Ld... Ravensworth Castle, Gateshead  
 Rawes, John... Springwood Cottage, Chorley  
 Rawlence, James... Bulbridge, Wilton, Salisbury  
 Rawlinson, Robt... Graythwaite, Newton-in-Cartmel

Rawson, Richard... Wheat Hill, Roby, Prescot  
 †Ray, Samuel... St. Paul's, Belchamp, Halstead  
 Rayer, John... Eastington, Northleach  
 Rayer, Wm. Carew... Tidcombe, Tiverton  
 †Raynbird, Hugh... Church Street, Basingstoke  
 Raynbird, Robert... Hengrave, Bury St. Edmund's  
 Rayne, Septimus William... Newcastle-on-Tyne  
 Rayner, Henry... Ely  
 Rea, Charles... Doddington, Wooler, Northumb.  
 †Read, Clare Sewell... Plumstead, Norwich  
 †Read, Geo., jun... Baxton Hall, Brandon, Norfolk  
 Read, Henry... London Road, Beccles  
 Read, James Marsh... Elkstone, Cheltenham  
 Reay, Matthew... Heworth, Gateshead  
 Reay, Robert... Berwick Hill, Newcastle-on-Tyne  
 Reading, William... Ashorne, Leamington  
 Redmayne, J. M... Saltwell, Gateshead  
 Reed, Mary... Seghill, Newcastle-on-Tyne  
 Rees, W. Treharne... Holly House, Newport, Mon.  
 Reeve, Major-Gen... Leadenham, Grantham  
 Reeves, J. R... Hantsland, Crawley Down, Sussex  
 Reeves, Robert... Bratton, Westbury  
 Reid, Andrew... Newcastle-on-Tyne  
 Reid, David... 41, Grey Street, Newcastle-on-Tyne  
 Reid, Edward... 29, Sandhill, Newcastle-on-Tyne  
 Reid, Sir John Rae, Bart... The Grove, Ewell  
 Relph, G. R. Greenhow... Beech Hill, Usk  
 Rendle, William Edgcombe... 68, Welbeck St., W.  
 Rennoldson, J. P... Jesmond Vale Ho., Newc.-on-T.  
 Reynardson, Henry Birch... Adwell, Tetsworth  
 Reynolds, Joseph Benj... Lubbethorpe, Leicester  
 †Reynolds, Dr. William... Coed-dû, Mold  
 Rhodes, J. Armitage... Roundhay, Leeds  
 Rhodes, James... Seal Lodge, Farnham, Surrey  
 †Ricards, Mortimer... Bure Homage, Christchurch  
 Rice, Edward Royd... Dane Court, Wingham  
 Rich, Stiles... Didmarton, Chippingham  
 †Richards, Edward Priest... Cardiff  
 †Richards, John... Llynclyes, Oswestry  
 †Richardson, E., jun... Chem. Manure Wks., Blaydon  
 Richardson, G... Bridlington Quay, Yorkshire  
 Richardson, Henry... Cherry Hill, York  
 Richardson, James... 104, Percy St., Newcastle-on-T.  
 Richardson, Jasper... Victoria Ter., Newcastle-on-T.  
 Richardson, J... Northlands House, Winterton, Brigg  
 Richardson, John... Alnwick  
 Richardson, John... Asgarby, Spilsby  
 Richardson, J. B... Shotley Park, Gateshead  
 Richardson, J. M... 14, Victoria Ter., Newcastle-on-T.  
 Richardson, Sir J. S., Bt... Pitfour Castle, Perth, N.B.  
 Richardson, J. W... Willoughton, Kirton-in-Lindsay  
 Richardson, Jonathan... Glenmore, Lisburn, Antrim  
 Richardson, Richard... Halewood, Prescot, Lanc.  
 †Richardson, Robt... Rainford, St. Helen's, Lanc.  
 Richardson, Capt. Thos... Sutton Hurst, Barcombe  
 Richardson, T., M.D... 17, Framlington Pl., Newc.-on-T.  
 Richardson, T. M... Hibaldstow Grange, Kirton  
 †Richmond, Duke of... Goodwood, Chichester  
 Richmond, Francis... Salford, Manchester  
 Richmond, William... 62, South John St., Liverpool  
 Rickard, Martyn William... Devonport  
 Riddell, E... Cheeseburn Grange, Newcastle-on-Ty.  
 †Riddell, Henry Buchanan... The Palace, Maidstone



- Riddell, John... Bewick Folly, Alnwick  
 Riddell, T.... The Park, Felton, Northumberland  
 †Riddell, Sir W. B., Bt.... Hepple Rothbury, Morpeth  
 Rider, Joseph... Leeds  
 Ridge, T. J.... Hambledon, Horndean, Hampshire  
 Ridgway, Capt. Alex.... Blackanton, Totnes  
 Ridgway, John... Fairlawn, Wrotham, Kent  
 †Ridgway, J.... Cauldon Pl., Shelton, Stoke-on-Trent  
 Ridgway, Thomas... Lymm, Warrington  
 †Ridler, Richard H.... Gatterlop, Leominster  
 Ridley, Andrew... Newcastle-on-Tyne  
 Ridley, J.... Park End, Hexham  
 Ridley, J. M.... Walwick Hall, Hexham  
 Ridley, T. D.... Chelmsford  
 Rigby, Thomas... Finney Wood, Winsford, Cheshire  
 Rigden, Richard Henry... Salisbury  
 Rigden, William... Hove Farm, Brighton  
 Rigg, Joseph... Filloughby, Coventry  
 Riley, Edmund... South Dalton, Beverley  
 †Riley, Luke... Meriden, Coventry  
 Riley, W. F.... Forest Hill, Windsor  
 Rimell, R., jun.... Tedney, Whitbourne, Worcester  
 Rimell, Wm.... Berrington Court, Campden, Gloucester  
 Ringer, John... West Harling, East Harling, Norfolk  
 Rising, Robert... Horsey, Great Yarmouth  
 Rising, Wm.... Somerton Hall, Great Yarmouth  
 Risley, Rev. W. C.... Deddington, Banbury  
 Rist, Isaac... Tattingstone, Ipswich  
 †River, John...  
 Rivers, Lord... Rushmore Lodge, Ludwell, Salisbury  
 Rix, Benjamin... St. Matthew's, Ipswich  
 Rix, John, sen.... Lusley Court, Worcester  
 Rix, Nathaniel, jun.... London Colney, St. Alban's  
 Roads, J.... Ashmore Farm, Addington, Winslow  
 †Robarts, A. J.... Lillingstone Dayrell, Bucks  
 Roberts, Bennett S.... 10, Abbey Square, Chester  
 Roberts, Charles G.... R. A. College, Cirencester  
 Roberts, Edw.... Almshoe Bury, Hitchin  
 Roberts, Hugh... Eastgate Row, Chester  
 Roberts, Joseph... Southleigh, Truro  
 Roberts, Richard... Burrington, Ludlow  
 Roberts, Thomas Lloyd... Corfton Hall, Bromfield  
 Roberts, Thomas... Ivington Bury, Leominster  
 Roberts, Wm. Harvey... Trehiddle, St. Austell  
 †Roberts, Wightwick... Trethill, Sheiok  
 Robertson, John, J. E.... Naish Farm, Christchurch  
 Robey, Robert... Canwick Road, Lincoln  
 Robinson, D.... Clitheroe Castle, Clitheroe  
 Robinson, George... Whiston, Shiffall  
 Robinson, G.... Slimbridge, Stonehouse, Gloucesters.  
 Robinson, Isaac... Iron Foundry, Halesworth  
 Robinson, Jas.... Huggart's Farm, Brindle, Chorley  
 Robinson, John... Mark Lane, Leeds  
 Robinson, John... Wootton Lodge, Gloucester  
 Robinson, J.... Roseforth Cott., Gosforth, Newc.-on-T.  
 Robinson, Col. John George... 21, Montagu Sq., W.  
 Robinson, John Rudly... Hutton Rudly, York  
 Robinson, John G.... Oakley Hl., Bishop's Stortford  
 Robinson, Sir J. S., Bt... Rokeby Hall, Louth, Ireland  
 †Robinson, Jos.... Clifton Pastures, Newport Pagnel  
 Robinson, Richard... Utkinton, Tarporley  
 Robinson, Rowland... Penny Drayton, Nuneaton  
 Robinson, Thomas... Nuthill, Hedon, Yorkshire  
 Robinson, Thomas... Castle Ashby, Northampton  
 Robinson, William... Bone Hill, Tamworth  
 Robinson, William... Heatley Lymm, Cheshire  
 Robotham, A.... Oak Farm, Drayton Bass., Tamworth  
 Robson, Daniel... Saltwell, Gateshead, Durham  
 Robson, James... Brackenborough, Louth  
 Robson, John... Fawdon House, Newcastle-on-Tyne  
 Robson, John... 3, Forth Street, Newcastle-on-Tyne  
 Robson, John... Sunnyside, Newcastle-on-Tyne  
 †Robson, John... Bymess, Rochester, Northumb.  
 Robson, Ralph... Hexham  
 Robson, William... Wilton, Salisbury  
 Robson, Wm... 2, Leazes Terrace, Newcastle-on-T.  
 †Roch, Nicholas... Paskiston, Pembroke  
 Roche, James John... Glastonbury  
 †Rodd, F.... Trebartha Hall, Launceston  
 Roddam, J. J.... Newtown, Stanhope, Darlington  
 Roddam, Wm... Roddam, Wooller, Northumberland  
 Rodgett, Miles... West Cliffe, Preston Lancashire  
 Rodwell, William... Woodlands, Holbrook  
 †Roebuck, J. A., M.P.... 19, Ashley Place, S.W.  
 Rogers, Henry... Stagenhoe Park, Welwyn  
 †Rogers, John J.... Penrose, Helston  
 †Rolf, C. Fawcett Neville... Sedgford Hall, Lynn  
 Rolls, John E. W.... The Hendre, Monmouth  
 Rolt, John... Ozleworth Park, Gloucester  
 Romilly, Edward... Porthkerry, Cardiff  
 Romney, Earl of... The Mote, Maidstone  
 Ronaldson, J. T.... Low Elswick, Newcastle-on-Tyne  
 †Rooper, George... Nascott House, Watford  
 †Rooper, J. B.... Abbotts Ripton, Hunts  
 Root, William... Chipping Warden, Banbury  
 †Roper, R. S. D. R.... Sedbury Pk., Richmond, Yks.  
 Roper, William... Ling, Lebergham, Cumberland  
 Rose, Christopher... Zeals Green, Mere, Wiltshire  
 Rose, Philip... Rayners, High Wycombe, Bucks  
 Rosewarne, John... Nanpuska, Hayle, Cornwall  
 †Ross, James... Hoo Park Farm, Luton  
 †Rothwell, R. R.... Sharples Hall, Bolton, Lancashire  
 Rotton, Richard... 3, Boltons, Brompton, S.W.  
 Round, Chas. Grey... Birch Hall, Colchester  
 Rous, Col. G....  
 Rous, Hon. Wm. Rufus... Worstead House, Norwich  
 †Rouse-Boughton, Sir C. H., Bt... Downton Hall, Ludl.  
 Row, E. T.... Moulds Haugh, Acklington  
 Row, Wm. North... Cove, Tiverton  
 Rowe, Samuel... Nursted House, Petersfield  
 Rowe, W. Wevill... Gt. Hay, Tamerton, Tavistock  
 Rowell, H.... Coally Hill, Walbottle, Newcastle-on-T.  
 Rowland, Edward... Claygate House, Esher  
 Rowland, John... Hollybank, Woodstock  
 †Rowland, R.... Creslow, Aylesbury  
 Rowlandson, Charles... The College, Durham  
 †Rowlandson, Samuel... The College, Durham  
 Rowlandson, Samuel... Newton Morrell, Darlington  
 Rowley, George W... St. Neot's  
 Rowley, Hon. R. T.... Rhyderddwyn Faur, Rhuddlan  
 Rowley, John Geo.... Rockstowes House, Dursley  
 Rowley, John Jephson... Rowthorne, Chesterfield  
 Roxby, W. Wright... Lovaine Ter., Newcastle-on-T.  
 †Royds, Albert Hudson... Falinge, Rochdale  
 †Royds, Henry... Elm House, Wavertree, Liverpool  
 †Royds, Rev. John... Heysham Rectory, Lancaster



†Royston, Viscount...Wimpole, Cambridgeshire  
 Ruck, Edmund...Castle Hill, Cricklade  
 Ruck, Lawrence...9, Staple Inn, W.C.  
 Rudyerd, Henry...Iver, Uxbridge  
 Rumball, H...The Hollies, Four Oaks, Sutton Colef.  
 Rumbold, C. J. A...5, Percival Terrace, Brighton  
 Ruse, Robertson...Warfield, Bracknell, Berks  
 †Russell, Lord C. J. F...Drakeloe Lodge, Woburn  
 Russell, Sir Chas., Bt...Swallowfield, Reading  
 Russell, David...Clifton Lodge, York  
 Russell, James...Brimstage, Birkenhead  
 Russell, John...Risca House, Newport, Mon.  
 †Russell, Robert...Pilmuir, Leven, Fife  
 Russell, Robert...Farningham, Dartford  
 †Russell, Sir W., Bt., M.P...Charlton Pk., Cheltenham  
 Rust, James...Alconbury, Huntingdon  
 Rust, Wm. Holyoake...Good Easter, Chelmsford  
 Ruston, A. S...Aylesby Ho., Chatteris, Isle of Ely  
 Ruston, Joseph...Lincoln  
 Rutson, Wm...Newby Wisk, Northallerton  
 Rutzen, Baron F. de...Slebeck Hall, Haverfordwest  
 †Ryder, Hon. G. D...Westbrook, Hemel Hempsted  
 Ryder, T. B...57A, Church Street, Liverpool  
 Ryland, T...Gt. Lister Street Works, Birmingham  
 Ryland, W. Hawkes...Bewdley, Worcester  
 Rylatt, W...Branswell, Seaford

S.

Sabin, John...Harbury, Southam, Warwickshire  
 Sadler, Henry...Mid-Lavant, Chichester  
 Sadler, R. S...The Valley Ho., Langham, Colches.  
 Sadler, T. W...Norton Mains, Ratho, Edinburgh  
 Sadler, Thomas...Chiddingfold, Surrey  
 Sadler, William...Chiddingfold, Surrey  
 Sadler, Wm...Ferry Gate, Dirleton, Haddingtonsh.  
 Sadler, William James...Calcutt, Cricklade  
 Sainsbury, W...Hunts Ho., W. Lavington, Deizes  
 †St. Alban's, Duke of...Redbourne Hall, Brigg  
 †St. Leger, Major John...Park Hill, Rotherham  
 †St. Maur, Lord Archibald...Burton, Loughborough  
 Sallit, Matthew...Saxlingham, Norwich  
 †Salkeld, Thomas...Holme Hill, Carlisle  
 Salomons, David...Broom Hill, Tonbridge  
 Salt Herbert...Methley Park, Leeds  
 Salt, Thomas...Weeping Cross, Stafford  
 Salt, Titus...Methley Park, Leeds  
 Salter, W. F., jun...The Abbey, Thetford  
 Saltmarsh, Philip...Saltmarsh, Howden  
 Salusbury, Rev. Thelwall J. T...Offley, Hitchin  
 †Salvin, M. C...Sarnsfield Court, Kington, Hereford  
 Samman, Wm...Middleton Park, Bicester  
 Samman, John...Broadwell, Moreton-in-the-Marsh  
 Sample, Thomas...Bothal Castle, Morpeth  
 Sampson, H. Atkins...Rowney Abbey, Ware  
 Sampson, Thomas...Moor Hall, Ninfeld, Battle  
 Samuelson, B...Britannia Iron Works, Banbury  
 Sanday, W...Holme-Pierrepont, Nottinghamshire  
 †Sandbach, H. R...Hafodunos, Llanrwst, Denbighs.  
 Sanders, E. A...Stoke House, Exeter  
 Sanderson, Hastings...5, Binsdown E., Leamington

Sanderson, Jas. 15, Manchester Blds., Westminster, S.W.  
 Sanderson, R. B., jun...N. Jesmond, Newcastle-on-Tyne  
 †Sandford, Mark...Martin, Dover  
 Sandle, Wm...52, Upper Brunswick Pl., Brighton  
 Sandwich, Earl of...Hinchingsbrooke House, Hunts  
 †Satterfield, Joshua...Alderley Edge, Manchester  
 Saunders, James...St. Paul's, Clapham, S.  
 Saunders, Randle Wm...Nunwick Hall, Penrith  
 †Saunders, Thos. B...Priory, Bradford-on-Avon  
 Saunders, T. H...Watercombe, Dorchester, Dorset  
 †Saunders, William Wilson...Hillfield, Reigate  
 Savage, S. Powell...Leys Farm, Wootton-under-Edge  
 Savery, A. B...Hardwick Lodge, Cheltenham  
 Savidge, Mat...The Lodge Farm, Chipping Norton  
 Savill, John...Orange Hall, Gosfield, Halstead  
 Savory, James...Tewkesbury  
 Savory, Paul Haines...Gloucester  
 †Savignon, Don D...Mexico  
 Sawyer, Charles...Heywood Lodge, Maidenhead  
 Saxby, Thomas...West Fife, Lewes  
 Saxelby, Thos...Urecote Hall, Hampton-in-Arden  
 Say, R. Hall...Oakley Court, Windsor  
 Sayers, John...Field Dalling, Holt, Thetford  
 Scarborough, John L...Colyford, Axminster  
 Scarsdale, Lord...Kedleston Hall, Derby  
 Scarth, Jonathan...Shrewsbury  
 Scarth, Thos. Freshfield...Keverstone, Darlington  
 Scarth, William Thomas...Keverstone, Darlington  
 Scawin, Thomas...Durham  
 Schmaltz, Gustavus...Ryton, Newcastle-on-Tyne  
 Schueider, Henry W...Lightburne Ho., Ulverston  
 Schollick, E. Jones...Aldingham Hall, Ulverston  
 †Schwann, F. S...N. Houghton Manor, Stockbridge  
 Scoones, H. B...  
 Scott, Col. Hon. C. Grantham...79, Eaton Sq., S.W.  
 Scott, Jas. Winter...Rotherfield Park, Alton, Hants  
 Scott, J...Green Head, Milnthorpe, Westmoreland  
 Scott, John David...Park Road, Newcastle-on-Tyne  
 Scott, John Fife...Eldon Street, Newcastle-on-Tyne  
 Scott, Joseph...Carlton Place, Newcastle-on-Tyne  
 Scott, Joseph...Colney Hall, Norwich  
 Scott, Thomas...Broomhouse, Beal, Northumberland  
 Scott, Thomas...18, Parliament Street, S.W.  
 Scott, Thomas Edward...Crandall, Farnham, Surrey  
 Scott, William...Empshot Grange, Petersfield  
 Scott, Wm. C...Thorpe, Chertsey  
 Scott, William Henry...Tynemouth  
 Scragg, Thomas...Calveley, Tarporley  
 †Scragg, William...Great Clacton, Colchester  
 †Scrutton, D. R...Prittlewell Priory, Rochford  
 †Scriven, E...Wormleighton Ha., Southam, Warwk.  
 Scriven, George...Castle Ashby, Northampton  
 Scudamore, John...Pengeley Court, Ross  
 Scudamore, Lt.-Col...Kentchurch Court, Hereford  
 Seager, James Iys...Carroun Ho., S. Lambeth, S.  
 Seal, Charles Wm...Leighdelamere, Chippenham  
 Seaman, Joseph...Worcester  
 Seamark, Richard...Mount St. Alban's, Caerleon  
 Searson, R...Cranmore Lodge, Market Deeping  
 Seawell, Thos. Aug...Marelands, Farnham, Surrey  
 †Sedgwick, Professor...Trinity College, Cambridge  
 Seels, Henry John...Wainfleet Hall, Lincolnshire  
 Selmes, James...Tufton Pl., Northiam, Staplehurst

Senhouse, Capt. Wm....Ashby St. Ledgers, Rugby  
 Seppings, T. Johnson...South Creak, Fakenham  
 †Severn, J. P....Penybont Hall, Penybont, Radnorsh.  
 Seward, Samuel...Weston, Petersfield  
 Sewell, Daniel...Beaumont Hall, Colchester  
 Sewell, Rev. Thos....The Cottage, Bolney, Cuckfield  
 Sexton, George...Wherstead, Ipswich  
 †Sexton, G. Mumford...Wherstead Hall, Ipswich  
 Seymour, H. D., M.P....Knolly House, Hindon, Wilts  
 Seymour, Capt. Henry...Park Place, Old Windsor  
 †Seymour, Rev. Sir J. H. C....Berkhamstead  
 Shackel, George...Earley Court, Reading  
 Shackle, Thomas...Hayes, Uxbridge  
 Shackleton, John...Scarcroft, Leeds  
 Shaftesbury, Earl of...St. Giles', Cranbourne  
 Shafto, R. D., M.P....Hampworth Lodge, Salisbury  
 Shafto, T. D....Cheveney House, Hunton, Maidstone  
 Shann, Charles...Inholes, Tadcaster  
 Sharman, S....Home Farm, Little Crosby, Liverpl.  
 Sharp Granville...Dean Scales, Cocker mouth  
 Sharp, Henry Morton...Monks Hardwicke, St. Neot's  
 Sharp, Isaac...Dairyknoll, Middlesbrough-on-Tees  
 Sharp, William...Shottesbrook, Maidenhead  
 Sharpe, Robert...Hewelsfield Court, Chesham  
 Sharpe, William...Mavis Enderby, Spilsby  
 Sharpe, W. Barling...Baker's Cross, Cranbrook, Kent  
 Shaw, Alex. Nesbitt...Newhall, Fortrose, Rosshire  
 Shaw, Chas. H....Woodbine Cottage, Hackney, N.E.  
 Shaw, F. G....Seaham Lodge, Seaham Harbr., Durhm.  
 Shaw, H. Geo....The Hollies, Wilmslow, Cheshire  
 †Shaw, John...Beddington Lodge, Croydon, S.  
 Shaw, John...New Wortley, Leeds  
 Shaw, John...Huntsbury Hill, Northampton  
 Shaw, William...Cold Norton, Stone, Staffordshire  
 Shaw, William...Far Coton, Northampton  
 †Shawe, R. F....Brantingham Hall, Hull  
 Shearer, B. P....Swanmore House, Bishop's Waltham  
 Sheffield, Earl of...Sheffield Park, Uckfield  
 Sheffield, Sir R., Bt....Normanby Park, Brigg  
 †Sheild, W. H....Lampeter Valley, Narberth  
 †Sheldon, H. J....Brailes House, Shipston-on-Stour  
 †Sheldon, John...Western Hill, Durham  
 †Sheldon, Jonathan...Eynsham, Oxford  
 Sheldrake, E....Ixworth, Thorpe, Bury St. Edmund's  
 Shellabear, Samuel...Holkham, Wells, Norfolk  
 Shepherd, Joseph...Torpoint, Cornwall  
 Shepherd, Edw....Bovington Farm, Wool, Wareham  
 Sheppard, J. G....Ashe High Ho., Wickham Market  
 †Sherard, Lord...Glatton, Stilton, Hunts  
 Sherborn, Francis...Bedfont, Hounslow, W.  
 †Sherborn, Francis, jun....Bedfont, Hounslow, W.  
 Sherbrooke, H. Porter...Oxton, Southwell, Notts  
 Sheridan, R. B., M.P....Frampton Court, Dorchester  
 Sheriff, Alex. C....Worcester  
 Shield, James, jun....Ancroft, Beal  
 Shield, John...66, Grey Street, Newcastle-on-Tyne  
 Shiell, John...Kenton, Newcastle-on-Tyne  
 †Shillingford, George Wm....Eynsham, Oxford  
 Shingler, Hugh...Hopesay, Aston-on-Clune, Salop  
 Shingler, J. H....Birch Hall, Ellesmere  
 Shipman, Thomas...Croxtan Lodge, Grantham  
 Shipperdon, Rev. E. H....Hermitage, Chester-le-St.  
 Shipway, Wm....Hanley Castle, Upton-on-Severn

Shirley, Thomas...Newport, Bishop's Stortford  
 Shittler, Wm. Rowden...Bishopstone, Salisbury  
 Shorthose, J....Shield Field Green, Newc.-on-Tyne  
 †Shuter, James...Crookham, Newbury  
 †Shuttleworth, Joseph...Hartsholme Hall, Lincoln  
 Sibley, Robert...Annables Farm, Luton  
 Sidney, P. Joseph Malow...Cowpen Ho., Northum.  
 Sidney, S...St. Alban's Cot., Northend, Fulham, S.W.  
 Sikes, John...Sudbury, Suffolk  
 Sill, Rev. J. P....Witheringsett Rectory, Stonham  
 †Sills, William...Cathorpe, Grantham  
 †Sillifant, John...Coombe, Copplestone, Devon  
 Silvester, Francis R....St. Alban's  
 Simcoe, Rev. H. A....Penheale, Launceston  
 Simeon, Sir J., Bart....Swainston, Isle of Wight  
 Simmons, Thos....East Peckham, Tonbridge, Kent  
 Simon, James...Greenfield, Holywell, Flintshire  
 †Simonds, J. Cabourne...Fishtoft, Boston  
 †Simonds, Thomas...Roundhay Grange, Leeds  
 Simonds, W. Barrow...Abbott's Barton, Winchester  
 Simpkin, Benjamin...Hoby, Leicestershire  
 Simpson, Alex....Teawig, Beanly, Invernesshire  
 Simpson, Alexander...Hull  
 Simpson, Benjamin Soulbey...Boston  
 Simpson, E. Thornhill...Walton, Wakefield  
 Simpson, H. Bridgman...Babworth, Retford, Notts  
 Simpson, John...Pyle Hotel, Bridgend  
 Simpson, John...East Barnet, N.  
 Simpson, John...Potterspury, Stony Stratford  
 Simpson, Joseph...Spofforth Park, Weatherby  
 †Simpson, Pinder...29, Saville Row, W.  
 Simpson, Rich....The Cliffe, Douglas, Isle of Man  
 Simpson, S. W....Kingham Hill, Chipping Norton  
 Simpson, S. W....North Laiths, Rufford, Ollerton  
 Simpson, Thos....High Street, Lincoln  
 Sims, W. Dyllwyn...Ipswich  
 Sinclair, John...Glenurquhach, Inverness  
 †Sisson, Robert James...Talardy, St. Asaph  
 Sitwell, Rev. H. W....Stainsby House, Derby  
 Sitwell, Robert Sacheverill...Merley, Derby  
 Skelton, W....Sutton Bridge, Long Sutton, Lincolnsh.  
 Skillicorne, W. Nash...Cheltenham  
 Skipworth, G. B....Moortown House, Caistor  
 Skipworth, W....South Kelsey, Brigg  
 Skirving, William...15, Queen Square, Liverpool  
 †Slade, A. F....Kemnal House, Chiselmhurst  
 †Sladen, Charles...Geelong, Victoria, Australia  
 Sladen, Douglas B....2, King's Arms Yard, E.C.  
 Sladen, Joseph...Hartsbourne Manor, Bushey Heath  
 Sladen, St. Barbe...14, Parliament Street, S.W.  
 Slater, Cyrus...Dunkirk, Holmes Chapel  
 Slater, Martin...Weston Colville, Newmarket  
 Slaton, Thomas...Market Place, Boston  
 Slatter, William...Stratton, Cirencester  
 Sleigh, Holmes...Ellerton Grange, Newport, Salop  
 Slye, Wm. Walter...Beaumont Castle, Lancaster  
 Smallbones, G. B....Sternickel & Lintenis, Vienna  
 Smallpiece, Job...Compton, Guildford  
 Smart, G....Woodhouse Grange, Aberford, Milford  
 Smart, Major George John...Tumby, Boston  
 Smart, William Lynn...Linden, Woburn  
 Smedley, C. E. B....Shottle House, Belper  
 Smijth, Sir William Bowyer, Bt....Hill Hall, Epping

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 Smith, Alexander M.... Kent Street, Liverpool  
 Smith, Apsley... 10, Hungershall Park, Tunbridge  
 †Smith, Augustus... 1, Eaton Square, S.W.  
 Smith, Charles... Kent Street, Liverpool  
 Smith, Charles Edward...  
 †Smith, Sir Chas. C. W., Bt.... Suttons, Romford, E.  
 †Smith, C. R.... Filkin's Hall, Lechlade  
 Smith, D., jun.... Martley Hall, Wickham Market  
 †Smith, Edw.... Ratcliffe-on-Trent  
 †Smith, Edward James... 14, Whitehall Place, S.W.  
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 †Smith, George... The Luham, Penrith  
 Smith, Graham... Easton Grey, Malmesbury  
 Smith, Geo. Robt... Selsdon Park, Croydon, S.  
 Smith, Henry Abel... Welford, Nottingham  
 Smith, Henry... Cropwell, Bingham, Notts  
 Smith, Henry... Eshe Hall, Durham  
 Smith, Henry John... Emsworth  
 Smith, Hen... New House, Sutton Maddock, Shiffnal  
 Smith, Henry... Brierly Hill  
 Smith, Henry Trefusis... Devonport  
 Smith, Hugh...  
 Smith, James... Little Moyle, Carlow, Ireland  
 Smith, James... Stanstead, Chichester  
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 †Smith, J. Metcalf... Leeds  
 †Smith, John...  
 Smith, John... Althrey, Wrexham  
 Smith, John... Breder Hills, Grantham  
 Smith, John... Fradswell Hall, Stone, Staffordshire  
 Smith, John... Crownthorpe, Wymondham  
 Smith, John... Marton Lodge, Bridlington  
 Smith, John... Sevenhampton, Andoversford  
 Smith, John... The Hundred, Romsey  
 †Smith, Sir John J., Bt.... Down House, Blandford  
 Smith, John P.... Hereford  
 Smith, John Philip... Lower Wick, Worcester  
 Smith, Rev. John Tetley... Repton, Burton-on-Trent  
 Smith, John T.... Thornby Grange, Guilsborough  
 Smith, Joseph... Henley-in-Arden  
 Smith, Joseph Lambourne... Ledbury  
 Smith, Martin T., M.P... 13, Upper Belgrave St., S.W.  
 Smith, M. P...  
 Smith, Richard... Tunbridge Wells  
 Smith, Richard Booth... Huxley Farm, Edmonton, N.  
 Smith, Robert... Heath Farm, St. Alban's  
 †Smith, Robert... Goldings, Hertford  
 Smith, Robert... Emmett's Grange, South Molton  
 Smith, Robert Thursfield... Whitchurch, Salop  
 Smith, Rev. S.... Lois Weedon Vicarage, Worcester  
 Smith, Thomas... Little Mollington, Chester  
 Smith, T. Fenton... Usworth, Gateshead  
 Smith, Thomas Robert... Shreshill, Wolverhampton  
 Smith, Thosoe... Hinchwick Farm, Stow-on-the-Wold  
 †Smith, Sir Wm., Bt.... Eardiston House, Worcester  
 Smith, William... Chimhams, Farningham, Dartford  
 Smith, William W.... Colwood Park, Cuckfield  
 †Smith, William... Winchcomb, Gloucestershire  
 †Smith, William... Bibury, Fairford  
 Smith, William... Gathorpe, Goole, Yorkshire  
 S mith, William... Kettering

Smith, William... Littlehales, Newport, Shropshire  
 Smith, William Arthur... Colebrook Park, Tunbridge  
 †Smith, W. B.... Stoneleigh Villa, Leamington  
 Smith, William J.... Monkland, Leominster  
 Smith, William Robert... Rushford, Evesham  
 Smithers, William... Sondes Place Farm, Dorking  
 Smithin, Benjamin... Sheriff's Leuch, Evesham  
 Smithin, Joseph... Wadborough, Kempsey  
 Smithson, Geo.... 101, Bristol Road, Birmingham  
 Smyth, James... Peasenhall, Witham  
 †Smyth, John George... Heath Hall, Wakefield  
 Smyth, William... Little Houghton, Northampton  
 Smith, Rev. William... Elkington Hall, Louth  
 Smythe, Sir C. F., Bt.... Acton Burnell, Shrewsbury  
 †Smythies, Carleton... Norton Rectory, Faversham  
 †Smythies, George... Leintwardine, Salop  
 Sneezum, Thomas...  
 †Snell, John F.... Great Bardfield Lodge, Braintree  
 Snelling, Charles... Holywell Farm, Watford  
 Snow, Cyprian... Dunston, Sleaford  
 Snow, Rev. George D'Oyley... Pimperne, Blandford  
 Snow, James M.... Metherringham, Sleaford  
 Snowball, William... Monkton, Gateshead  
 Snowden, William... Longford, Gloucester  
 Soames, D. W.... Harrow Weald, Stanmore, N.W.  
 Solley, George Bushell... Monkton Court, Ramsgate  
 Somerset, John... Milton, Pewsey, Wilts  
 †Somerville, J. C.... Dinder Ho., Wells, Somersetsh.  
 Souley, W.... Kirby Moorside, Yorkshire  
 †Southall, Thomas, Worcester  
 Sowerby, Francis... Aylesby, Great Grimsby  
 Sowerby, John... Shipcote, Gateshead  
 Spain, George... Hackling, Sandwich  
 Spanton, Robert... Little Thorns Farm, Swaffham  
 Spark, William... Shilton House, Coventry  
 †Sparks, William... Crewkerne  
 Speakman, Thomas... Doddington Park, Nantwich  
 Spearing, J. B.... Portland Lodge, Park Town, Oxf.  
 Spearing, William... Kennett, Marlborough  
 Spence, John F.... Chirton Cottage, North Shields  
 Spencer, Earl... Althorp, Northampton  
 Spencer, Capt.... Kirby Stephen, Westmoreland  
 †Spencer, E.... Bircher, Leominster  
 Spencer, Francis... Claybrooke, Lutterworth  
 Spencer, James, jun.... Newcastle-on-Tyne  
 Spencer, John... Corn Market, Doncaster  
 Spencer, John... 12, Catherine Terrace, Gateshead  
 Spencer, John, jun.... Whorlton Hall, Newc.-on-Tyne  
 Spencer, J. W., jun.... Whorlton Hall, Newc.-on-T.  
 †Spencer, M.... Millfield, Newburn, Blaydon-on-T.  
 Spencer, Samuel... Snarestone, Ashby-de-la-Zouch  
 Spencer, Thos... The Grove, Ryton, Blaydon-on-Tyne  
 Spencer, William... Team Villa, Gateshead  
 †Spicer, J. W. Gooch... 35, Belgrave Square, S.W.  
 Spill, George... Hackney Wick, N.E.  
 Spinks, Abraham... West Bilney, Lynn  
 Sp Platt, William Francis... Abbotsford, Torquay  
 Spooner, Prof. C.... Roy. Veter. College, N.W.  
 Spooner, Thomas... Burton-upon-Trent  
 Spooner, Richard, M.P.... Birmingham  
 Spooner, William Charles... Southampton  
 Spragge, Francis Hoare... Oeton House, Torquay  
 Spraggon, Benjamin... Nafferton, Stocksfield



- Squarey, Elias P....Odstock, Salisbury  
 Squire, Edward Frederick...Cross Hall, St. Neot's  
 Squire, William...5, Coleman Street, E.C.  
 Stable, Charles Leonard...Crayford, S.E.  
 Stable, Robert Scott...The Park, Wanstead, N.E.  
 †Stables, W. A....Cawdor Castle, Nairnshire, N.B.  
 Stafford, Robert...31, Hyde Park Square, W.  
 Stafford, Thomas...Marnham, Nottingham  
 Stainton, John...Dalby, Spilsby  
 Stallard, John...Worcester  
 Stallard, Josiah...Worcester  
 Stallard, William...Brockhampton, Ross  
 Stamford & Warrington, Earl of...Eville Ho., Stour.  
 Standing, Thomas...Fishergate, Preston  
 †Standish, W. Standish...Duxbury Park, Chorley  
 Stane, John Bramston...Forest Hall, Ongar  
 Stanford, Walter...Parham, Storrington, Sussex  
 Stanford, W., jun....Steining Court Farm, Steyning  
 †Stanhope, J. B., M.P....Revesby Abbey, Boston  
 Stanier, J. E....Seaton, Wellington, Salop  
 †Stanforth, Rev. Thos....Storr's Hall, Windermere  
 Stanley, Edward...14, Grosvenor Square, W.  
 Stanley, E....The Height, Newton-in-Cartmel  
 †Stanley, Lord, M.P....Knowsley, Prescott  
 Stanley, Henry...Upton, Shifnal  
 Stanley, W. H. S., jun....21, Curzon St., May Fair, W.  
 Stansfield, W. R. C....Esholt Hall, Leeds  
 Stanton, Henry...79, Coleman Street, E.C.  
 Stark, Michael J....Duke's Palace Bridge, Norwich  
 Starkey, Major L. C....Wrenbury Hall, Nantwich  
 †Starkey, J. Bayntun...Spye Park, Chippenham  
 Starmer, Chas....Handley, Spilsby  
 Statham, Rev. R. J....Rectory, Tarporley  
 Statter, Thomas...Knowsley Hall, Bury, Lancashire  
 Stawell, Col. Alcock...Kilbrittain, Bandon, Cork  
 Stead, Titus Bennett...Leeds  
 Stearn, Samuel G....Brandestone, Wickham Market  
 Stebbing, Henry...Stow Bedon Hall, Attleboro'  
 †Stedman, James...Luton, Leominster  
 Stedman, Robert...Pakenham, Bury St. Edmund's  
 Stedman, Wm....Bedstone Hall, Aston, Shrewsbury  
 Steedman, George...Hall Green, Birmingham  
 Steedman, Joseph...Meriden, Coventry  
 Stenning, Edward...Stratton House, Godstone  
 Stenning, William...Halsford, East Grinstead  
 Stenton, Henry Cawdron...Southwell  
 Stephens, Charles...Earley Court, Reading  
 Stephens, E....Trewornan, Wadebridge, Cornwall  
 Stephens, Rev. Ferd. T....St. Mawgan, Cornwall  
 Stephens, George...Cropthorne, Pershore  
 Stephens, H. L....Tregenna Castle, Hayle, Cornwall  
 Stephens, J....23, Eastbourne Terr., Hyde Park, W.  
 †Stephens, Robert...Ive's Place, Maidenhead  
 Stephens, S. H....Ofoxe, Tong, Shifnal  
 Stephens, S. J....5, Charlotte Street, Portland Pl., W.  
 Stephenson, Clement...Newcastle-on-Tyne  
 Stephenson, Hugh...Throckley Ho., Newc.-on-Tyne  
 Stephenson, Marshall...Fourstones, Hexnam  
 Stephenson, Wm....Throckley Ho., Newc.-on-Tyne  
 Sterriker, John...Driffield  
 †Stevens, John...Holywell Street, Oxford  
 Stevens, J. Curzon Moore...Winscott, Torrington  
 †Stevens, Rev. T....Bradfield Rectory, Reading  
 Stevens, William Carr...33, Mark Lane, E.C.  
 Stevens, William...Gatehampton, Reading  
 †Stevenson, Capt. C. B....Hennor House, Leominster  
 Stevenson, T. T....Byker, Newcastle-on-Tyne  
 Steward, A. Benn...Chapel House, Whitehaven  
 Steward, Charles...Thurleston Lodge, Ipswich  
 †Steward, Chas....Blundeston, Lowestoft  
 Steward, Wm....Lambton, Fence Houses  
 †Stewart, Alexander J. R....Ard House, Donegal  
 Stewart, Andrew...Newcastle-on-Tyne  
 Stewart, Arthur...Barton House, Gloucester  
 Stickney, William...Ridgmont, Hull  
 Stiles, Stephen...Shirburn Farm, Tetsworth  
 Stilgoe, Henry...Chapel Ascot, Southam  
 Still, Henry Chelsham...Croydon, S.  
 Stilwell, J. J. R....Fairfield, Chiddingfold, Surrey  
 †Stirling, William, M.P....Keir House, Perthshire  
 Stirling, Sir W., Bt....Burrs Wood, Tunbridge Wells  
 Stock, S....Blackley Hurst, St. Helen's, Lancashire  
 Stocker, J. P....93, Oxford Terrace, W.  
 Stokes, Charles...Kingston, Kegworth, Derby  
 Stone, J. J....Ashton Vil., Upper Lewisham Rd., S.E.  
 Stone, John S....Newport, Monmouthshire  
 Stone, N. Chamberlain...Ayleston Hall, Leicester  
 †Stoneham, Frederick...Crayford  
 Stonehewer, W. S., jun....Brunswick Terr., Brighton  
 Stopford, W. Bruce...Drayton House, Thrapstone  
 Storer, C., M.D....Lowdham Grange, Nottingham  
 Storer, Rev. John...Hellidon, Daventry  
 †Storarr, Robert...Grittleton, Chippenham  
 Story, J. B....Lockington Hall, Derby  
 Stott, John...Bothal Barns, Morpeth  
 Stott, Mrs....Eccleshill Hall, Leeds  
 Stowell, William Stow, jun....Darlington  
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 †Stracey, Henry J....Rackheath Hall, Norwich  
 Strachan, J. M....Teddington Grove, S.W.  
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 Strangway, Henry Bull...Shapwick, Bath  
 †Stratford, H.S....Thorpe Lubenham Hl., Market Harb.  
 Straw, Fred...Stones Place, Skellingthorpe, Linc.  
 †Strathallan, Visc...Strathallan Castle, Auchterarder  
 Stratton, George...Spinnymoor House, Durham  
 †Stratton, J. Locke...Turveston House, Brackley  
 Stratton, Richard...Stapleton, Bristol  
 Strelly, Richard Clayton...Buckland Hollow, Belper  
 Streeker, William...Sanderstead, Croydon, S.  
 Strickland, Walter...Cokethorpe Park, Witney  
 †Strickland, Chas. William...Boynton, Bridlington  
 Strode, Geo. S....Newnham Park, Plympton, Devon  
 Stronge, Thomas...Cirencester  
 †Stuart, Lt.-Col. Wm., M.P....Kempston, Bedford  
 Stubbs, Chas...Preston Hill, Penkridge  
 Stubbs, John...Weston Hall, Stafford  
 Stuckey, H....Cotthelstone, Bp.'s Lydeard, Taunton  
 Stucley, Lt.-Col. Sir G.S., Bt...Hartland Abbey, Bidef.  
 Sturgeon, Chas...South Ockenden Hall, Romford, E.  
 Sturgess, Thomas...Penshurst, Tunbridge  
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 Suffolk, Earl of...Charlton, Malmesbury  
 Sumner, Rev. C. V. H....Ringwould Rectory, Dover  
 Surman, J. Surman...Swindon Hall, Cheltenham



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 Surtees, Robert L...Redworth House, Darlington  
 Surtees, Villiers C. V...Benbridge Ho., Newc.-on-T.  
 †Surtees, Wm. Edward...Tainfield Ho., Taunton  
 Sutcliffe, Rev. Thos...Royd Ho., Heptonstall, York  
 †Sutherland, Duke of, K.G...Trentham Pk., Newc.-u-  
 Sutton, John...Moston Manor, Sandbach [Line  
 †Sutton, Martin Hope...Portland Place, Reading  
 Swafield, Benj...Pilsbury, Ashborne, Derbyshire  
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 Swaine, S. H...Bradford, Yorkshire  
 Swan, Joseph...Newcastle-on-Tyne  
 Swan, Joseph...High House, Morpeth  
 Swan, Mark...Lesbury, Alnwick  
 Swan, Richard...North Shields  
 Swan, Richard...Newcastle-on-Tyne  
 Swan, Wm...Walker, Newcastle-on-Tyne  
 Swan, W. R...Wall's End, Newcastle-upon-Tyne  
 Swann, John...Bedlington, Morpeth  
 Swann, William...Bedlington, Morpeth  
 Sweeten, Benjamin Thomas...Ash Grove, Penrith  
 †Swete, John B...  
 Swinburne, George...Red Hills, Penrith  
 Swinburne, T. W...Winchcomb, Gloucestershire  
 Swinford, John...Strode Place, Herne, Kent  
 Swinnerton, Robert...Weddington, Nuneaton  
 Swords, H...Hallingbury Hall, Bishop Stortford  
 Swords, J...West Mill, Bury, Buntingford, Herts  
 Swords, William...Tawney Hall, Romford, E.  
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 Sykes, John...Croes Howell, Wrexham  
 †Symonds, Thomas Powell...Pengethley, Ross  
 Symondson, Geo...Upshire Ha., Waltham Abbey, N.  
 Symons, Thomas George...Mynde Park, Ross  
 †Synge, Francis Hutchinson...Dysart Lodge, Corofin

T.

Tabley, Lord de...Tabley House, Knutsford  
 Tait, Henry...Shaw Farm, Windsor  
 †Talbot, Henry...Cockfield Hall, Sudbury  
 Talbot, C. R. M., M.P...Margam, Glamorganshire  
 Talbot, de Malahide, Lord...Malahide Cas., Dublin  
 Talbot, Hon. & Rev., G. G. C...Withington, Chelt.  
 Talbot, Hon. Col. W. P...Honeybourne, Gloucester  
 Talbot, Wm...Lane House, Burton, Westmoreland  
 Talbot, Wm., jun...Lane Ho., Burton, Westmoreld.  
 Talbot, Wm. H...Southport, Lancashire  
 Tallant, Francis...Elmsted, Ashford, Kent  
 Tamplin, R. G...Morrastone, Ross, Hereford  
 Tanner, Henry...Victoria Road, Cotham, Bristol  
 Tanner, Joseph...Mudeford House, Christchurch  
 †Tanner, William...Patcham, Brighton  
 Tanton, E...Hill Farm, Torrington, Devon  
 Tappley, E. S...Knowlton, Wingham  
 Tasker, William...Waterloo Iron Works, Andover  
 Tate, John...Bilton, Alnwick  
 Tattersall, E...1, Tattersall's Yd., Grosvenor Pl., S.W.  
 Tattersall, John...Great Ealing, W.

Tattersall, William...Kirkstall Bridge, Leeds  
 Tatton, T. W...Wythenshawe Hall, Manchester  
 Taunton, William...Redlynch, Salisbury  
 Tavendale, Joseph...Pendley Farm, Tring  
 Tawney, A. R...Banbury  
 Tayler, Rowland...Colchester  
 Taylor, Charles...The Green, Bromyard  
 Taylor, Sir Charles, Bt...Forest Lodge, Liphook  
 †Taylor, Chas. H...Bamburgh Friars, Belford  
 Taylor, Francis Howard...Burntwood Hall, Barfshley  
 Taylor, George...Dudley, Staffordshire  
 †Taylor, George Edward...Oatlands, Leeds  
 Taylor, Henry T...Holmer House, Hereford  
 Taylor, James...Stretford Court, Leominster  
 Taylor, James...Newcastle-on-Tyne  
 †Taylor, J...Burnfoot House, Wigton, Cumberland  
 Taylor, John...Moreton Hall, Whalley, Blackburn  
 Taylor, John...Aston Clinton, Tring  
 Taylor, John...Rajmahal, Bengal  
 Taylor, J., jun...Sandycroft Farm, Hawarden, Chester  
 †Taylor, Joseph...Bishop's Stortford  
 Taylor, Mark...Aston Tirrell, Wallingford  
 †Taylor, R...6, Queen St. Pl., Up. Thames St., E.C.  
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 †Taylor, Sam...Eccleston Hall, Prescott, Lancashire  
 †Taylor, Simon W...Erechfort Manor Ho., Devizes  
 Taylor, Thomas...Burleigh Villa, Wellington, Salop  
 Taylor, Thomas...Ashton House, Tetsworth  
 Taylor, T. Loombe...Starston, Harleston, Norfolk  
 Taylor, William...Harpree Court, Bristol  
 Taylor, William...Addington Lodge, Croydon S.  
 Taylor, Wm...Showle Court, Stoke Edith, Hereford  
 Taylor, William...Groby Cottage, Leicester  
 Taylor, William...Thingehill Court, Hereford  
 Taylor, Wm. Hy...High Hatton, Shawbury, Salop  
 Tayton, William...Syderstone, Fakenham  
 Teasdale, Robert...71, Westgate St., Newc.-on-Tyne  
 †Teleki, Countess Harley...Eywood, Rington, Herefd.  
 Temperley, J...Eland Hall, Ponteland, Northumb.  
 Temperley, W. Angus...Westfield House, Hexham  
 †Tempest, C. Henry...Broomlands, Nantwich  
 Tempest, Colonel...Tong Hall, Leeds  
 Tempest, F. Roger...Ackworth Grange, Pontefract  
 Tempest, Sir C...Broughton Hall, Skipton, Yorkshire  
 †Templemore, Lord...Dunmoby Pk., Wexford, Ireland  
 Templeton, A...Glanhenwy, Glasbury, Hereford  
 Templetown, Visct...27, George St., Hanover Sq., W.  
 Tench, John...Ludlow  
 Tennant, Joseph Mason...Headingley, Leeds  
 Tennant, J. R...Kildwick Hall, Skipton, Yorkshire  
 †Tennant, Robert...Scarcroft Lodge, Leeds  
 Tennant, Thomas...Blenheim Terrace, Leeds  
 Terry, Edward, jun...Walton, Aylesbury  
 Teverson, Henry...High Garrett, Braintree  
 Terry, Rev. Stephen...Dummer, Basingstoke  
 Thackeray, Capt...Junior United Serv. Club, S.W.  
 Thackwell, John Cam...Dymock, Gloucestershire  
 †Thew, Edward...Lesbury House, Alnwick  
 Thistlethwaite, Thomas...Southwick Pk., Fareham  
 Thomas, David...Brecon  
 Thomas, E. David...Welfield House, Builth, Brecon  
 Thomas, F. H...Hereford

Thomas, George...18, Redcliff Street, Bristol  
 †Thomas, G. T.... Ermatingen, Thurgovie, Switzerl.  
 Thomas, John... Bletsoe, Bedford  
 Thomas, L. H.... Caerfynnon, Talsarna, Caernarvon  
 Thomas, R. Goring... Ferry Side, Carmarthen  
 Thomas, Rees... Dolellan, Llandysil, Carmarthen  
 Thomas, Thomas... St. Hilary, Cowbridge  
 †Thomas, Rev. W. J.... Llan Thomas, Hay, Herefordsh.  
 Thomasson, William... Barnby Moor, East Retford  
 Thompson, Alexander... Kirknewton, Wooler  
 †Thompson, Andrew... Berwick-on-Tweed  
 Thompson, Andrew... Keele, Newcastle-under-Lyme  
 †Thompson, Anthony... Cross, Whitehaven  
 Thompson, Cuthbert... Winlaton, Blaydon-on-Tyne  
 Thompson, Francis... Burton-on-Trent  
 Thompson, Capt. F. W... Willow Lod., Finchley, N.  
 Thompson, George... Dudley, Worcestershire  
 Thompson, George... Havelock St., Newc.-on-Tyne  
 Thompson, G. A.... Kirkhouse, Brampton, Cumberl.  
 Thompson, Henry A.... Lewes  
 Thompson, James... Bishop Auckland Durham  
 Thompson, John... Paston, Coldstream  
 †Thompson, John... Badminton, Chippenham  
 †Thompson, John B.... Anlaby, Hull  
 Thompson, Leonard... Sheriff Hutton Park, York  
 Thompson, Matt.... Kirby Stephen, Westmoreland  
 Thompson, Thos. H.... Cavil Head, Acklington  
 Thompson, W.... 12, Dunsford Place, Bathwick, Bath  
 †Thompson, W., jun... Thorpe-le-Soken, Colchester  
 †Thompson, William... Weymouth  
 Thompson, William... Esh Lande, Esh, Durham  
 Thompson, William... Tregoyd Farm, Hay  
 Thomson, Guy... Old Bank, Oxford  
 Thomson, R. J.... Grange, Kilmarnock  
 Thomson, Robert T.... Broomford Manor, Exbourne  
 Thomson, Wm. C.... Dilston Haugh, Cumberidge  
 Thorn, James... Brackinburg, Penrith  
 †Thornes, Joseph... Green House, Ossett, Wakefield  
 Thornhill, George... Diddington, Huntingdon  
 Thornhill, Obadiah... Barthomley, Crewe  
 †Thornhill, T.... Riddlesworth Hall, Thetford  
 Thornhill, Wm. Capel Clarke... Rushton, Kettering  
 †Thornhill, W. P., M.P.... Stanton Hall, Bakewell  
 Thornton, C. George... Marden Hill, Hertford  
 Thornton, Edward... Little Pitchford, Shrewsbury  
 Thornton, Harry... Turvey, Newport Pagnell  
 †Thorold, Richard... Weelsby Hall, Grimsby  
 Thorp, R. H.... Temple, Selby  
 †Thorp, Thomas... Alnwick  
 †Thorp, Ven. Archd. T... Kemerton Rect., Tewkesbury  
 Thorp, T. H.... Broyle Place Farm, Ringmer, Lewes  
 Thorpe, J. Cole... Otley Ho., Walesby, Market Rasen  
 Thoyts, Mortimer G... Sulhamstead House, Reading  
 Thresher, Fred. R.... Marsh Ho., Bentley, Farnham  
 Thring, Robert... 9, Whitehall Place, S.W.  
 †Throckmorton, Sir W., Bt... Buckland, Faringdon  
 †Thurlow, T. Lyon... Baynard Park, Guildford  
 †Thurnall, Henry... Royston, Herts  
 Thursby, Rev. F.... Abington Rectory, Northampton  
 Thursby, Major John H... Snyderdale Hall, Pontefract  
 Thursfield, T. H.... Barrow, Brosely  
 Thynne, F. George... Fleaford Lodge, Guildford

†Tibbits, Capt. J. Borlace... Barton Seagrave, Kettering  
 Tierssonnier, Alphonse... Colombier, Nevers, France  
 Tiffen, Joseph... North Skirlaugh, Hull  
 †Tighe, Rt. Hon. Wm. F.... Inistioge, Ireland  
 Tilden, John... Ifield Court, Gravesend  
 †Tillard, Philip... Stukeley Hall, Huntingdon  
 †Timbrell, Robert... Beckford, Tewkesbury  
 Timm, Joseph...  
 Timmis, Richard... Darlington St., Wolverhampton  
 Timson, Rev. Edward... Tatchbury, Southampton  
 Tindal, C. G.... Blackgang, Isle of Wight  
 Tinkler, Robert... Penrith  
 †Tinne, John A.... Briarley, Aigburth, Liverpool  
 Tippler, Wm.... Roxwell, Chelmsford  
 †Todd, John... Mireside, Wigton, Aspatia, Cumb.  
 Todd, John... Bardou Pl., Jesmond, Newc.-on-Tyne  
 Toder, John... South Muskham, Newark-on-Trent  
 †Tollemache, H. B.... Jun. United Service Cl., S.W.  
 †Tollemache, J., M.P.... Tilston Lodge, Tarporey  
 Tombs, John... Hatherop, Fairford  
 Tombs, J. King... Lanford, Lechlade  
 Tomes, Alfred... Rouse Lench, Evesham  
 Tomkinson, William... Newcastle, Staffs.  
 Tomlin, H. Currer... St. Margaret's, Ware  
 Tomline, Col. G., M.P.... 1, Carlton Ho. Ter., S.W.  
 Tomlinson, Capt. Frederick W.... Leamington  
 Tomlinson, J. Edward...  
 Tomlinson, Wm... Biggins House, Kirkby Lonsdale  
 Tompson, Edw. C. S... Dromenagh, Iver, Uxbridge  
 Tompson, H. Kett... Wychingham Hall, Norwich  
 Tompson, R. James... Iver House, Uxbridge  
 Tomson, James... Barnt Green, Bromsgrove  
 Tonge, Charles... Ashfield House, Lincoln  
 Tonge, W., sen... Chevening, Sevenoaks  
 †Tooke, Rev. J. T. H.... Scawby Vicarage, Brigg  
 Tooke, William... 12, Russell Square, W.C.  
 Toomer, G. Edw.... Hoaden House, Ash, Sandwich  
 †Torr, William... Aylesby Manor, Great Grimsby  
 Torrens, Robert, M.P.... Ramsdale, Bracknell  
 Toulson, John Parker... Skipwith Hall, Selby  
 Tovey, Robert... Fairford  
 Toward, Andrew... Osborne, Isle of Wight  
 Towell, Samuel... Rutland House, Newmarket  
 Tower, Christopher T... Weald Hall, Brentwood  
 Towgood, Edward... St. Neot's  
 Townend, Thomas... Knockholt, Kent  
 Townley, Rev. Gale... Beaupre Hall, Wisbeach  
 Townsend, G. Barnard... The Close, Salisbury  
 Townsend, Hen... Rydinghurst, Cranley, Guildford  
 †Townsend, Rev. C. G. G.... Hatfield Peverel  
 Townsend, W. H... Shantian House, Cotham, Bristol  
 Townshend, Charles... Pulford, Chester  
 Traherne, G. M... St. Hilary, Glamorganshire  
 Travers, Peter F... Great Carlton, Louth  
 Treadwell, John... Waddesdon, Aylesbury  
 Trebeck, Thomas... Southwell  
 Treby, Henry Hele... Goodamoor, Plympton, Devon  
 Tredwell, John... Leigham Court, Streatham Hill, S.  
 †Tredgar, Lord... Tredgar Park, Newport  
 Tregelles, E. O... Derwent Hill, Shotley Bridge  
 †Treherne, Morgan...  
 Tréhonnais, R. F. de la... The Elms, Bickley Pk., S.E.

†Teemayne, John...Heligan, St. Austle  
 †Trench, Henry...Cangort Park, Roscrea, Ireland  
 Trench, W. S...Essex Castle, Carrickmacross, Ireland  
 Trethewy, Alfred H...Blickling, Aylsham, Norfolk  
 Trethewy, Henry...Grampound  
 Trethewy, Henry, jun...Silsoe, Beds  
 Trevelyan, Sir W. C., Bt...Wallington, Newc.-on-T.  
 Trimmer, Charles...Alton, Hants  
 Trinder, Edward...Cirencester  
 Trinder, Thomas...Sandlin, Leigh Sinton, Malvern  
 Trollope, Sir J., Bart., M.P...Caswick, Stamford  
 Trood, Edward...Matford House, Exminster  
 Trotter, Theodore...Greetwell House, Lincoln  
 Trotter, Thomas...Bywell, Stocksfield  
 Trotter, William...South Acomb, Stocksfield  
 Trouncer, J. H., M.D...6, Mount Street, W.  
 Trower, Capt. E. S...Stanstead Park, Ware  
 Trumper, Edward...Nuneham Park, Oxford  
 Trumper, Joseph...Lake End, Burnham, Bucks  
 †Tryon, T...Bulwick, Wansford, Northamptonshire  
 Tuck, Rev. G. R...Blofield, Norwich  
 Tuck, Henry...Shirley, Ringwood  
 Tuck, Henry...The Hall, Ingatstone  
 Tucker, Edwin...Frogmore Street, Abergavenny  
 †Tucker, Henry...Bourton Ho., Shrivenham, Berks  
 †Tuckett, P. D., jun...76, Old Broad Street, E.C.  
 †Tudor, Geo. S...Park House, Lapley, Penkridge  
 †Tull, Henry...Crookham, Newbury  
 †Tull, Richard...Crookham, Newbury  
 Turk, William...Charlton Kings, Cheltenham  
 Turnbull, Edward...West Hartlepool  
 Turnbull, George...Horton, Belford  
 †Turnbull, John George...Pinner, Watford  
 †Turnbull, Rev. T. S...Blofield, Norfolk  
 Turnbull, William...Horton, Belford  
 †Turnbull, W...2, West George St., Newc.-on-Tyne  
 Turner, E. R. T...St. Peter's Iron Works, Ipswich  
 Turner, Frederic...Palmer's Green, Southgate, N.  
 Turner, Fred. John...The Dean, Kilmarnock, Ayr  
 Turner, Fred...St. Peter's Iron Works, Ipswich  
 Turner, George...Beacon Downes, Exeter  
 Turner, George, jun...Alexton Hall, Uppingham  
 †Turner, Lieut.-Col. F. Henry...Gouray, Jersey  
 Turner, J. Singer...Chyngton Farm, Seaford, Lewes  
 Turner, John...Stanwell, Staines  
 Turner, John...Englefield, Reading  
 Turnaer, J. H...Little Horringer Hall, Bury St. Edm.  
 Turner, John James...Newcastle-on-Tyne  
 Turner, J. W...Hopton, Mirfield, Normanton  
 Turner, Philip...The Leen, Pembridge, Herefordsh.  
 Turner, P. Henry...Whitlocksworthy, Kingsbridge  
 Turner, William...Newtown, Montgomery  
 Turner, William, jun...Stourton, Birkenhead  
 †Turner, W. Beckett...Penleigh House, Westbury  
 †Turnor, Christopher...Stoke, Grantham  
 Turnor, Michael...Brereton, Rugeley  
 Turvill, G...Manor Farm, East Shalford, Guildford  
 Tuson, Rich. V...R. V. College, Camden Town, N.W.  
 Tuxford, Jos. Shephard...Skirbeck, Boston  
 Tweddle, John...  
 Tuxford, Weston...Boston  
 Twitchell, Thomas...Willington, Bedford  
 Tylden, Lt.-Col. Sir J...Milsted, Sittingbourne

Tyler, John...Leyton, Essex, N.E.  
 Tyler, Rev. Roper T...Llantrithyd, Cowbridge  
 †Tyler, Sir Jas., Kt...Pine House, Holloway, N.  
 Tyrell, Sir J. T., Bart...Boreham Ho., Chelmsford  
 †Tyringham, Wm. B...Tyringham, Newport Pagnel  
 Tyrell, John...St. Leonard's, Exeter

## U.

Umbers, Abraham...Weston Hall, Leamington  
 †Umbers, Edward...Wappenbury, Leamington  
 Umbers, Samuel...Wappenbury, Leamington  
 †Umfreville, S. C...Ingress Abbey, Greenhithe  
 Underhill, W. S...Newport, Salop  
 †Underwood, Joseph...5, Hyde Park Gardens, W.  
 Unsworth, John...The Thorn, Penrith  
 Unthank, John...Netherseales, Penrith  
 Uplill, Thomas B...Sheepcote Street, Birmingham  
 †Upperton, Robert...35, Steyne, Brighton  
 Upton, H., jun...Aldwick, Bognor  
 Upward, A...  
 Urwick, Edward...Felton, Ludlow  
 †Usedom, Baron von...Berlin  
 Usher, George M...Railway Street, Beverley  
 Usher, John...Eldon Street, Newcastle-on-Tyne

## V.

Vaizey, George De Horne...Halstead  
 †Vaizey, John Robert...Attwoods, Halstead  
 Vallance, James...Hurstpierpont  
 †Valle, Conde Del...Vergana Gurpoisea, Spain  
 Vallentine, R...Barcott Lo. Fm., Leighton Buzzard  
 Valpy, Robert Harris...Ilfracombe  
 Vanderstegen, W. H...Cane End House, Henley  
 †Vane, Rev. John...Burrington, Bristol  
 Varnell, G. W...R.V. College, Camden Town, N.W.  
 Vaughan, John W...Velinnewidd House, Brecon  
 †Vaughan, Nash V. E...Rhesta, Neath, Glamorg.  
 Vaughan, William Brettell...Ludlow  
 †Vaux, Lord, of Harrowden...Highams, Bagshot  
 †Vavasour, Sir H. M., Bt...8, Up. Grosvenor St., W.  
 Veitch, Harry Jas...Exotic Nurseries, Chelsea, S.W.  
 Veitch, Jas., jun...Exotic Nurseries, Chelsea, S.W.  
 †Vere, John...Carlton-upon-Trent, Newark, Notts  
 †Verner, Edw. Wingfield...86, Eaton Square, S.W.  
 †Verney, Sir H., Bt., M.P...Claydon House, Winslow  
 †Vernon, Hon. A. H...Sudbury, Derby  
 Vernon, Hon. F. H...Farming Woods, Thrapstone  
 †Vernon, Harry F., M.P...Hanbury Hall, Droitwich  
 Vernon, Granville H...East Retford, Notts  
 Vernon, Hon. G. R...Farming Woods, Thrapstone  
 Vernon, Hon. & Rev. J. V...Nuttall Rec., Nottingham  
 Vernon, Robert...Broad Chare, Newcastle-on-Tyne  
 Vernon, William...Shaw Farm, Tarporley  
 Verrall, Richard Relfe...Falmer, Lewes  
 Vesey, Charles C...Lucan House, Lucan, Dublin  
 †Vevers, Charles...Ivington Park, Leominster  
 Vevers, J. Brace...Yarkhill Court, Ledbury  
 Viall, King...Stoke, Clare, Suffolk  
 Vickerman, Charles R...Thoby Priory, Brentwood  
 Vickers, Thomas...Ardwick Green, Manchester  
 †Vickers, V...Ellerton Grange, Newport, Salop  
 Villar, James...Charlton Kings, Cheltenham  
 Villiers, Hon. F. W. C...Welford, Northamptonshire



Vincent, H. Wm... Thornwood Lodge, Kensington, W.  
 † Vincent, James... Clifton Maybank, Yeovil  
 Vivian, Lord... Glynn, Bodmin  
 Vivian, George... 11, Upper Grosvenor Street, W.  
 Vivian, Maj.-Gen. Sir R. J. H., Bt., K.C.B. .Caterham  
 Voile, John, jun... Churchover, Rugby  
 † Voile, Thomas... Frolesworth, Lutterworth  
 Voss, Wm... West Bucknowle, Corfe Castle, Dorset

## W.

† Waddilove, G. M. D... Branton House, Hexham  
 † Waddingham, J... Guiting Grange, Winchcomb  
 Waddington, Edward... Wakefield  
 Waddington, J... Langrish, Petersfield  
 † Wade, R... 58, Upper Seymour St., Portman Sq., W.  
 Wade, R. Craven... Clonbranie, Crossakeile, Mea'h  
 Wagner, G. H. M... 77, Marina, St. Leonard's-on-Sea  
 † Wagstaff, Thomas... Stifford, Romford, E.  
 † Wainman, W. Bradley... Carhead, Crosshills, Leeds  
 Wainwright, C. Rawlinson... Shepton Mallet  
 Waites, John Merrick... Gloucester  
 Wakefield, George... Minworth, Birmingham  
 Wakefield, John... Sedgwick, Milnthorpe  
 † Wakefield, W. H... Prizet, Kendal  
 Walbey, Samuel... Barley, Royston  
 Waldron, J. Lovegrove... Ramsbury, Hungerford  
 Waldy, Edward... Barmpton, Darlington  
 Waldy, William... Great Burdon, Darlington  
 Walker, Caleb... Chillesford Lodge, Wickham Mrkt.  
 Walker, D. M... Gloucester  
 Walker, Elisha... Brereton, Sandbach  
 Walker, Sir E. S., Knt... Berry Hill, Mansfield  
 † Walker, Frederick James... Claxton Grange, York  
 Walker, George Henry... Newbold Grange, Rugby  
 Walker, G. H... Oakleigh, East Grinstead  
 Walker, G. J. Alexander... Norton, Worcester  
 Walker, James... Northleach  
 Walker, John... Goldington, Bedford  
 Walker, John... Westfield House, Holmer, Hereford  
 Walker, John Deverell... Nottingham  
 † Walker, John... Mount St. John, Thirsk  
 Walker, John... Newton Bank, Chester  
 † Walker, John... Cooper's Row, Tower Hill, E.C.  
 † Walker, John L... 71, Oxford Terrace, W.  
 Walker, Joseph Need... Calderstone, Liverpool  
 † Walker, Ormerod Oliver... Bury, Lancashire  
 Walker, Lawrence... 12, Bryanston Square, W.  
 Walker, Marmaduke... Addington Lod., Croydon, S.  
 Walker, R. C... Middlesex Grange, West Hartlepool  
 Walker, Richard Janion... Padeswood, Mold  
 Walker, Thomas... Stowell Park, Northleach  
 Walker, Thomas... The Woodlands, Doncaster  
 Walker, Thomas S... Maunby Hall, Thirsk  
 Walker, William... Beeston, Nottingham  
 † Walker, Wm. H... 38, Sackville Street, W.  
 Wall, Geo. Young, jun... 39, North Bailey, Durham  
 Wallace, John... Bossington, Stockbridge, Hants  
 Waller, H. E... Farmington, Northleach  
 Waller, F. S... Whittington Court, Andoversford  
 Waller, John Anthony... Brinkburn Ho., S. Shields  
 Waller, Thomas... Sutton Hall, Woodbridge  
 Waller, Tony... Westoe, South Shields

Wallington, George... Wellesbourne, Warwickshire  
 Wallis, Arthur... Basingstoke  
 Wallis, Edward... Garrett Lane, Wandsworth, S.W.  
 Wallis, George... Old Shifford, Bampton, Faringdon  
 Wallis, J. Smith... Drishane Castle, Mill St., Ireland  
 Wallis, O... Overstone Grange, Northampton  
 Wallis, Robert... Old Ridley, Stockfield, Northum.  
 Wallis, Samuel... Barton Seagrave, Kettering  
 Walsley, George... Rudston, Bridlington  
 † Walmesley, Richard... Standerwick Court, Frome  
 † Walrond, J. Walrond... Bradfield, Cullompton  
 Walter, John... Borden, Sittingbourne  
 Walter, Stephen... West Farleigh, Maidstone  
 Walter, William... Rainham, Sittingbourne  
 Walters, John... 10, Iron Gate, Derby  
 † Walters, William... Haverfordwest  
 Warburton, Rowland E. E... Arley Hall, Northwich  
 Ward, David... Iron Works, Melford, Sudbury  
 Ward, John... East Mersea, Colchester  
 Ward, Robert... Harrington, Uppingham  
 Ward, Samuel, R. C... Yaforth, Northallerton  
 Ward, Thos. J... Fern Park, Olveston, Gloucester  
 † Ward, Wm. Squire... Wellow Hall, Ollerton, Notts  
 Warde, Vice-Adm. Chas., K.H... Westerham, Kent  
 Ware, Rev. Charles... Astwood, Newport Pagnel  
 Ware, Jas. Thomas... 18, Gordon Square, W.C.  
 Waring, William... Chelsfield, Kent  
 Warman, Robert... Idstone, Shrivenham, Berks  
 Warner, C. Boreham... 8, Crescent, Jewin St., E.C.  
 † Warner, George... Priory, Hornsey, N.  
 Warner, Henry, jun... Hawkey, Petersfield  
 Warner, H. J. L., jun... Walsingham Abbey, Fakenham  
 Warner, J... Tixall Hall Farm, Stafford  
 Warner, Richard... Weston Hill, Nuneaton  
 † Warner, Thomas... 47, Sussex Square, Brighton  
 Warre, H... Bevendon Ho., Langford Budville, Som.  
 † Warren, Rev. J. C. B... Horkeley Hall, Colchester  
 † Warren, R. A... Preston Place, Arundel  
 Warren, Samuel... Newtown Iron Works, Ledbury  
 Warry, George... Shapwick, Glastonbury  
 Warter, H. de Grey... Oruch Meole Ho., Shrewsbury  
 † Watnaby, John R... Clipton, Northamptonshire  
 Warwick, Thomas... 35, Mark Lane, E.C.  
 Wason, Rigby... Covvor, Grivan, Ayrshire  
 Waterhouse, Samuel... Halifax  
 Waters, Benjamin... Newcastle-on-Tyne  
 Waters, Edward... Stratford Sub-Castle, Salisbury  
 Waters, John... Eastbourne  
 Waters, Richard... Broughton, Stockbridge  
 Waters, Robert... Saman, Carmarthen  
 Watham, Joseph Street... Coalbrook, Ross  
 Watkin, Ralph... Royal Exchange, Newc-on-Tyne  
 † Watkins, J. G... Woodfield, Ombersley, Worcester  
 Watkinson, Wm... New Market, Louth  
 Watney, Daniel... 26, Poultry, E.C.  
 Watson, Lt.-Col. C. E... 16, Devonshire Street, W.  
 Watson, George P... Londonthorpe, Grantham  
 Watson, Henry... Newcastle-on-Tyne  
 Watson, Henry G... 123, George Street, Edinburgh  
 Watson, John... Shirburn Castle, Tetsworth  
 Watson, John E... Newcastle-on-Tyne  
 † Watson, John... Waresby, Kidderminster  
 Watson, Joseph... Bensham Grove, Gateshead



Watson, Michael...Jesmond Cemetery, Newc.-on-T.  
 Watson, Robert...Scurrington, Whatton, Notts  
 Watson, Robert...Standard Hill, Nintfield, Battle  
 Watson, Robert H...Bolton Park, Wigton  
 Watson, Robert S...Moss Croft, Gateshead  
 Watt, J. W. Gibson...Doldolowe, Radnorshire  
 Watts, Bartholomew...Don Street, St. Heliers, Jersey  
 Watts, T. Copson...The Priory, Wolston, Coventry  
 Watton, G. B...Hall Farm, Longden, Shrewsbury  
 Watton, Jas...Cwmillecoediog, Cemmaes, Shrewsbury  
 Way, Lewis...Spencer Grange, Halstead  
 Way, L. A...Alderbourne, Gerrard's Cross, Bucks  
 Wayne, T. M...Manor Ho., S. Warrnborough, Odiham  
 Weal, Benjamin, jun...  
 Wealleans, J. D...Flotterton, Rothbury, Northum.  
 Weatherby, James...6, Burlington Street, W.  
 Weaver, Wm. Henry...Moor Farm, Bridgnorth  
 †Webb, C. J...Brooklands, Ormskirk  
 Webb, Frederick Pace...Evesham  
 †Webb, Henry...Chishill Hall, Saffron Walden  
 Webb, Henry...14, Foregate Street, Worcester  
 Webb, James...Spring Hill, Fladbury, Pershore  
 Webb, John...Horseheath, Linton, Cambridgeshire  
 Webb, Lankester...Combs Tannery, Stowmarket  
 †Webb, Richard James...Calcot Place, Reading  
 Webb, Samuel...Babraham, Cambridge  
 Webb, Thomas...Hildersham, Cambridge  
 Webb, Theodore Vincent...Caxton, Cambridge  
 Webb, William...Worcester  
 Webb, Wm...Chemical Manure Works, Worcester  
 Webb, Wm. Frederick...Newstead Abbey, Mansfield  
 Webbe, Rev. H. C...38, Jermyn Street, S. W.  
 †Webber, Charles Henry...Buckland, Barnstaple  
 Webber, Thos...Halberton Court, Tiverton  
 †Webster, Charles...Cowley, Uxbridge  
 Webster, F...Marley Farm, Battle Abbey, Sussex  
 Webster, James...Peakirk, Market Deeping  
 Webster, Capt. P. C. G...Hill Parsonage, Sutton Cold.  
 Webster, Samuel...Wadsworth Hall, Doncaster  
 †Webster, Wm. Bullock...  
 Wedd, Octavius...Foulmire, Royston  
 Weddle, John...Regent Terrace, Gateshead  
 Wedgwood, W. R...Greyshots Hl., Liphook, Hants  
 Weeks, Richard M...Ryton Park, Blaydon-on-Tyne  
 Weir, Edward...142, High Holborn, W.C.  
 Weiss, F...Bakeham House, Englefield Green  
 Welby, E. M. Earle...Denton Hall, Grantham  
 Welby, Rev. George Earle...Barrowby, Grantham  
 Welby-Gregory, Sir G. E., Bt...Denton, Grantham  
 Welby, J. Earle...Allington Hall, Grantham  
 Welby, Wm. Earle, M.P...Denton, Grantham  
 Welch, Henry T...Leck Hall, Kirkby Lonsdale  
 Welchman, Robert F...Southam, Warwickshire  
 Weld, E. J...Lulworth Castle, Wareham  
 Welford, R. G...Goff's Oak House, Cheshunt, N.  
 Wellington, Duke of...Apsley House, Piccadilly, W.  
 †Wells, Grenville G...Ashdown Ho., E. Grinstead  
 †Wells, John...Booth Ferry House, Howden  
 Wells, John...Hampnett, Northleach  
 Wells, Thomas...Norwich  
 †Wells, William...Holmewood, Peterborough  
 †Welsh, John...Kirkton, Hawick, N. B.  
 †Welsh, Fitzwilliam...Trough House, co. Limerick

Welstead, Fred...The Cottage, Stonely, Kimbolton  
 Wemyss, J. Hay Erskine...Wemyss Castle, N. B.  
 †Wenlock, Lord...Eserick Park, York  
 Wenman, Wm. Henry...Wiston, Shiffnal  
 Wentworth, Godfrey...Woolley Park, Wakefield  
 Were, Francis...Hinton Farm, Hlordean  
 West, J. Robert...Alscot Park, Stratford-on-Avon  
 West, J...Melton Ross, Brigg  
 West, Thomas...Worcester  
 †Westear, Henry...Burwood Cottage, Esher  
 †Western, Thomas Burch...Felix Hall, Kelvedon  
 †Western, T. Sutton, M.P...Felix Hall, Kelvedon  
 Westhead, J. P. Brown...Lea Castle, Kidderminster  
 †Westmoreland, Earl of...Apthorpe, Wandsford  
 Wethered, George...Maidenhead  
 †Weston, James...Stoneleigh, Kenilworth  
 Westray, Thomas...Spital, Chester  
 Wetton, Geo. Norman...Collington, Northampton  
 †Weyland, J...Woodrising Hall, Hingham, Norfolk  
 †Whalley, Chas. Lawson...Richmond Ho., Lancaster  
 Wharton, Rev. J. C...Gilling Vic., Richmond, Yks.  
 †Wharton, J. Thomas...Skelton Castle, Guisborough  
 Wharton, Rev. W. F...Barningham Rect., Winstow  
 Wheatley, John...Neswick, Driffield  
 Wheble, James Joseph...Bulmerhoe Court, Reading  
 Wheeler, A. C...Kingsholm, Gloucester  
 †Wheeler, E. V...Kyrewood House, Tenbury  
 Whitley, Jas. William...St. Julian's, Sevenoaks  
 Whinyates, Lt.-Gen. Sir E. C., K.C.B...Cheltenham  
 Whitaker, John...Leigh, Lancashire  
 Whitaker, Joseph...Ramsdale House, Nottingham  
 Whitaker, Joshua...Bratton, Westbury  
 †Whitbread, Sam. Chas...49, St. George's Sq., S.W.  
 †White, Algernon Holt...Clement's Hall, Rochford  
 White, D. B., M.D...Eldon Square, Newc.-on-Tyne  
 †White, Henry...Warrington  
 †White, H. Wm...Lentran House, Inverness, N. B.  
 White, J. A...Cloatley, Hankerton, Malmesbury  
 White, Rev. J...Chevington Rect., Bury St. Edmund's  
 †Whitear, R. B...Martyr Worth, Winchester  
 Whitehead, Charles...West Farleigh, Maidstone  
 †Whitehead, Jeffrey...8, Moorgate Street, E.C.  
 Whitehead, J...Barnjet, West Barming, Maidstone  
 Whitehead, John...Preston  
 Whitehead, Richard...West Farleigh, Maidstone  
 Whitehead, Wm...Newborough, Market Deeping  
 Whitford, Richard...Avon Side, Evesham  
 Whiting, Charles...Beaufort House, Strand, W.C.  
 Whitley, Nicholas...Truro  
 Whitlock, F...Lovingtons, Gt. Yeldham, Halstead  
 Whitmell, John...Crick, Rugby  
 †Whitmore, Thos...Apley Park, Bridgnorth  
 †Whitmore, Thos. C., M.P...Apley Park, Shiffnal  
 Whitmore, William...Wickham Market  
 Whittaker, H. T...East Plain, Newton-in-Carmel  
 Whittaker, S...Hawkstone Farm, Weston, Salop  
 †Whitting, Wm...Thorney, Peterborough  
 Whittle, E...Toller Fratum, Dorchester, Dorset  
 Whitworth, Geo...Jamaica Level, Rotherhithe, S.E.  
 Whitworth, H. B...Northampton  
 Whitworth, Joseph...Chorlton Street, Manchester  
 Whybro, Edward...Tottenham Green, N.  
 †Wicks, John...48, Princes Square, W.

†Wicksted, C... Thakenhurst, Cleobury Mortimer  
 Wickstead, Rev. Charles... Hafod, St. Asaph  
 Widdicombe, John... Treehill, Ivybridge, Devon  
 Wienholt, Frederick... Langharne, Carmarthen  
 Wigan, Edm... Lapley Brewood, Wolverhampton  
 Wiggins, Walter John... Watlington, Oxon  
 Wigham, George... Laverick Hall, Seaton Delaval  
 †Wight, J. L... Tedstone Ct., Bromyard, Hereford  
 Wightman, John... Chard  
 Wightwick, Thomas Norman... Canterbury  
 Wigmore, John... Weston-under-Penyard, Ross  
 †Wigsell, Capt. A. D... Sanderstead Court, Croydon, S.  
 †Wilbraham, Hugh... Westport, co. Mayo, Ireland  
 Wilbraham, Randle... Rode Heath, Lawton, Cheshire  
 Wild, Samuel Bagnall... Costock, Loughborough  
 Wild, T. M... 3, Montague Terrace, Loughbridge Wells  
 Wiley, Samuel... Bransby, York  
 Wilkin, Joseph... Chowden Hall, Gateshead  
 Wilkin, Ralph... Grey Street, Newcastle-on-Tyne  
 Wilkins, Edmund... Mortimer, Reading  
 Wilkins, Henry... Westbury-on-Severn, Gloucester  
 Wilkins, Walter... Gloucester  
 Wilkinson, Edwin... Isle of Cinder, Leeds  
 Wilkinson, Henry E... Pilgrim St., Newc-on-Tyne  
 Wilkinson, H. John... Walsham-le-Willows, Ixworth  
 Wilkinson, O. R... Eaton Socon  
 Wilkinson, Rev. P. S... Mount Oswald, Durham  
 Wilkinson, T. Aytoun... Kingstandale, Buxton  
 Wilkinson, Capt. Thos. H... Walsham, Ixworth  
 Wilkinson, William... Oxford  
 Willacy, Robert... Penwortham Priory, Preston  
 Willett, John S... Petticombe, Torrington  
 Willetts, William... Bishampton, Pershore  
 Williams, J. B... Glan Hafren, Garthmyl, Montg.  
 Williams, Rev. C... Gedling Rectory, Nottingham  
 Williams, Chas. H... Roath Court, Cardiff  
 †Williams, Ashley G... Easthampstead Pk., Wokingham  
 Williams, David... Kinmel Farm, St. Asaph  
 Williams, Edward... Celyn, Northop, Flintshire  
 Williams, Rev. Edward T... Caldicot, Chepstow  
 Williams, Edwin... Lenastone Farm, Ross  
 Williams, Fras. Edward... Malvern Hall, Solihull  
 †Williams, G... Buckland, Faringdon  
 †Williams, Henry E... Manor Ho., Braunston, Rugby  
 Williams, Sir Hugh, Bt... Bodelwyddan, St. Asaph  
 †Williams, James... Northcourt, Abingdon  
 Williams, Rev. James... Tring Park, Tring  
 Williams, John... Bank, Chester  
 Williams, John... Alstone, Cheltenham  
 Williams, John... Tynnycllyn, Chirk  
 Williams, Philip... Wednesbury Oak, Tipton  
 †Williams, R., jun... Bridehead, Dorchester, Dorset  
 Williams, T. P... 20, King St., St. James's, S.W.  
 Williams, William... Tregullov, Scorrier, Cornwall  
 †Williams, William... Pentraeth, Anglesea, N. W.  
 †Williams, W. E... Pwll-y-pant, Cardiff  
 †Williams, Rev. W. J... Glamorgan Street, Brecon  
 Williams, William Propert... Trehowell, Fishguard  
 Williams, W. R... Dolgelly  
 †Williamson, H... Greenway Bank, Burslem, Staffs.  
 Williamson, Sir H., Bt., M.P... Whitburn Ha., Sunder.  
 Williamson, Rev. R. H... Lamerley Parsonage, Gates.  
 †Williamson, W. E... Prinknash Park, Painswick

Willis, William... West Moulsey, S.W.  
 †Willich, C. M... 24, Suffolk Street, Pall-Mall, S.W.  
 †Willoughby, W...  
 Willsher, C. W... Weathersfield, Braintree  
 Wills, John... South Petherwyn, Launceston  
 Willson, Anthony... Ranceby Hall, Sleaford  
 †Williams, E. Brydges... Nanskeall, St. Colomh  
 Wilmot, Sir H. S., Bart... Chaddesden Hall, Derby  
 Wilmot, Rt. C... Woolley Park Farm, Wakefield  
 Wilson, Chas. R... Hipsbourne, Alnwick  
 Wilson, Frasers... Ludford, Market Rasen  
 Wilson, Henry J... Sherwood Hall, Mansfield  
 †Wilson, H. M... Stowlangtoft, Bury St. Edmund's  
 Wilson, H... V-garden Ter., Westgate, Newc-on-T.  
 Wilson, Jacob... Woodhorn Manor House, Morpeth  
 Wilson, Joseph... Manor Ho., Woodhorn, Morpeth  
 Wilson, Admiral John... The Howe, Windermere  
 Wilson, John Simpson... Royals Aston, Nantwich  
 †Wilson, Professor J... Iver, Uxbridge  
 †Wilson, J... Edington Mains, Ayton, Berwickshire  
 †Wilson, John... Seacroft Hall, Leeds  
 Wilson, J. Hewetson... The Grange, Worth, Sussex  
 Wilson, J. W... East Cheverington, Acklington  
 Wilson, Matthew... Eshton Hall, Gargrave, Leeds  
 †Wilson, Richard Basset... Cliffe House, Darlington  
 Wilson, Robt... Lincoln Villa, Hampstead, N.W.  
 †Wilson, T... Shotley Hall, Newcastle-upon-Tyne  
 Wilson, Thomas, jun... 20, Gloucester Square, W.  
 Wilson, Thomas... Oaklands, Newcastle-on-Tyne  
 †Wilson, Thomas Francis... Althorne, Maldon  
 Wilson, William... Baylham Hall, Ipswich  
 Wilson, William... Berkhamstead  
 Wilson, William... Bulcote, Nottingham  
 Wilson, William... Oubas Hill, Ulverston  
 Wilson, William B... Blagdon, Cramlington  
 †Wimbush, Barnes... Finchley, N.  
 †Winchester, Marquis of... Amport House, Andover  
 Winder, E. H. Lyon... Vaenor Park, Shrewsbury  
 Wing, Thomas Twining... Goldington, Bedford  
 †Wing, William... Market Overton, Oakham  
 Wingfield, Charles... Onslow Hall, Shrewsbury  
 Wingfield, John M... Tickencote Hall, Stamford  
 Wingfield, R. Baker... 2, Lowndes Square, S.W.  
 Winmill, S. P... Shopland, Rochford  
 Winn, Joseph... Uppingham  
 †Winn, Roland... Appleby Hall, Brigg  
 Winnall, John... Eccleswall Court, Ross  
 Winington, Sir T., Bt... Stanford Court, Worcester  
 †Winterbottom, Jas. E... East Woodhay, Newbury  
 Winterton, Thomas... Alrewas Hay, Lichfield  
 Winthrop, Rev. Benjamin... Clifton, Bristol  
 Wippell, John... The Barton, Alphonington, Exeter  
 Wise, Henry... Feltons, Brickham, Reigate  
 †Wise, Robert... Auburn Hill, Malton  
 †Witney, William... Hanover Street, W.  
 Witherington, C... Bradfield, Reading  
 Witherington, John... Germany House, Rugby  
 Withers, S. H... 242, Oxford Street, W.  
 †Withington, T. Ellames... Culcheth Hl., Warrington  
 †Withington, James... Rosedale, Tenbury  
 Wittenoom, Charles... Perth, Western Australia  
 †Wodehouse, Lord... Kimberley, Wymondham  
 Wodehouse, W. H... Woolmers Park, Hertford

Wollaston, Major F....Shenton Hall, Nuneaton  
 Wollen, Joseph...Wedmore, Somerset  
 Wolton, Samuel...Newbourn Hall, Woodbridge  
 †Wolton, Samuel, jun....Kesgrave, Woodbridge  
 †Wombwell, Sir G., Bart....Newburgh, Easingwold  
 †Wood, Rt. Hon. Sir C., Bart., M.P....Doncaster  
 Wood, Charles A....25, Chesham Place, S.W.  
 Wood, Maj. Edward A....Osmington, Weymouth  
 Wood, Edward...Hanger Hill, W.  
 Wood, Col. Edward Robert...Stout Hall, Swansea  
 †Wood, George...Hatchlands, Guildford  
 Wood, George...Rochford, Essex  
 Wood, George...Graham's Town, Cape of Good Hope  
 Wood, Henry...Woodhill, Send, Ripley, Surrey  
 Wood, James...Oakley, Hurstpierpoint  
 Wood, James...Pinwall Hall, Atherstone  
 Wood, John...Wrotham Park, Sevenoaks  
 †Wood, John...Sheddon Grange, Alton  
 Wood, John...Stanwick Park, Darlington  
 Wood, Joseph...Lansdowne Villa, Worcester  
 Wood, Richard...Potternewton, Leeds  
 Wood, Rev. R....Woodhall Park, Leyburn, Bedale  
 Wood, Rowland...Clapton, Thrapston  
 †Wood, Maj.-Gen. Thomas...Littleton, Chertsey  
 Wood, Walter A....77, Upper Thames Street, E.C.  
 Wood, William...Ifield Court, Crawley  
 Wood, William...Cockermouth  
 Wood, Willoughby...Holly Bank, Burton-on-Trent  
 †Wood, W. Bryan...Branbridge, Chippenham  
 Woodall, Thomas...Dinham, Chepstow  
 Woodburne, Thomas...Ulverstone  
 Woodd, B. T., M.P....Conyngham Hall, Knaresboro'  
 †Woodham, W. Nash...Shepreth, Melbourn, Camb.  
 Woodhams, W. R....The Hammonds, Rye  
 Woodhouse, Edward...Worcester  
 Woodhouse, John...Skerton, Lancaster  
 Woodman, Richard, jun....Glynde, Lewes  
 Woods, Edmund Freeman...Stowmarket  
 Woods, Henry...Merton, Thetford  
 †Woods, James...Stowmarket  
 Woods, John A....Benton Hall, Newcastle-on-Tyne  
 Woods, Matthew C....Jesmond Ho., Newc.-on-Tyne  
 †Woods, W. Leyland...Chilgrove, Chichester  
 Woodward, Henry...Stanway Hall, Colchester  
 Woodward, Joseph...Birlingham, Pershore  
 Woodward, Robert...Arling Castle, Bevdley  
 Woodward, Robert...Rise Hall, Akenham, Ipswich  
 Woodward, Thomas...High House, Severn Stoke  
 Woodward, Wm....Northway House, Tewkesbury  
 Woodward, Rev. W....Bidford Grange, Bromsgrove  
 †Woodyear, Rev. J. F. W....Crookhill, Doncaster  
 Woolcombe, John M....Ashbury, Okehampton  
 Woolbridge, H....Meon Stoke, Bishop's Waltham  
 Woolf, Joseph...Haslington Hall, Crewe  
 Woolf, Thos....Standon Hall, Eccleshall, Staffs.  
 Woolley, T. S., jun....So. Collingham, Newark, Notts  
 Woolton, Charles...Lynton Lodge, Clapham Pk., S.  
 Woolnough, Wm....Kingston, S.W.  
 Woolrich, Hopley Capper...Handley, Chester  
 Wooster, James...The Wrestlers, Elstree, N.W.  
 Worby, William...Ipswich  
 Worsey, John...Lower Clopton, Stratford-on-Avon  
 Worsley, Chas. Cavill...Platt, Manchester

Wortham, Biscoe Hilff...Royston, Herts  
 Worthington, Archibald...Whitechurch, Salop  
 Wortley, Edw....Ridlington, Uppingham  
 †Wrench, Robert...39, King William Street, E.C.  
 Wressell, John...Adlingfleet, Goole  
 Wrey, Sir Bouchier, Bart....The Chase, Ashburton  
 Wright, Edmund...Halston, Oswestry  
 Wright, Francis...Osmaston Manor, Derby  
 †Wright, Henry Banks...Sheldon Hall, Newark  
 Wright, James...Ravenhill, Rugeley  
 Wright, John...The Terrace, Chesterfield  
 Wright, John...Buxton, Norwich  
 Wright, John...Yeldersley House, Derby  
 Wright, John Francis...Kelvedon Hall, Brentwood  
 Wright, Joseph...Grace Street, Leeds  
 Wright, Robert John...Queen Street, Norwich  
 Wright, S. W....Grendon House, Castle Ashby  
 †Wright, Thomas...North Runceton, Lynn  
 Wright, Thos. Barr...The Quarry Ho., Great Barr  
 Wright, William...Sigglesworth, Holderness  
 Wright, William...Fring, Rougham, Norfolk  
 Wrightson, John...Spring Ho., Ladberge, Durham  
 †Wrightson, R. Heber...Warmsworth Hl., Doncaster  
 †Wrightson, W. B., M.P....Cusworth Park, Doncaster  
 Wyatt, Harvey...Acton Hill, Stafford  
 †Wyatt, William...Eyam, Bakewell  
 Wybergh, Francis...Isel Vicarage, Cockermouth  
 Wylam, E. H....North Leam, Gateshead  
 Wylam, Ralph...North Leam, Gateshead  
 †Wyley, James, jun....Longdon, Rugeley  
 †Wyley, Wm....Vineyard, Wellington, Shropshire  
 Wyndham, Capt. Alex....West Lodge, Blandford  
 †Wyndham, J. E....Wootton, Charmouth  
 Wyndham, J. H. C....Bishop's Waltham  
 †Wyndham, Wm....Dinton, Salisbury  
 Wynne, B. Wynne...Garthewin, Abergely, Denbigh.  
 Wynne, J. Ll., jun....Coed Coch, Abergely, Denbigh.  
 Wynne, Wm. W. E....Peniarth, Towyn, N. Wales  
 Wynniatt, R., jun....Dymock Grange, Gloucester  
 Wythes, F....Ravensden House, Bedford  
 †Wythes, George...Reigate

## Y.

†Yarborough, Earl of...Glanford Bridge, Lincolns.  
 Yardley, Sir Wm., Kt....Hadow Park, Tunbridge  
 Yates, Capt....Yearland Conyers, Lancaster  
 Yates, William...Grindle House, Shiffnal  
 Yellowley, Henry...Pilgrim St., Newcastle-on-Tyne  
 †Yeoman, Geo. Dundas...22, Coney Street, York  
 Yeoman, Thos. L....Woodlands, Richmond, Yorks.  
 Yonge, Rev. Wm. J....Rockbourne, Salisbury  
 Yorke, Hon. Eliot T., M.P....Wimpole, Cambridge  
 Yorke, Joseph...Forthampton Co., Tewkesbury  
 †Yorke, T. E....Halton Place, Hellfield, Leeds  
 Youll, M. M....Newcastle-on-Tyne  
 Young, A. A....Orlbury Ho., Wellingborough  
 Young, C. H....11, Ravensworth Ter., Newc.-on-Ty.  
 †Young, George...27, Mark Lane, E.C.  
 Young, John...Kenley House, Coulsdon, Croydon, S.

## Z.

†Zoeppritz, G....Ravensburg, Würtemberg, Germany



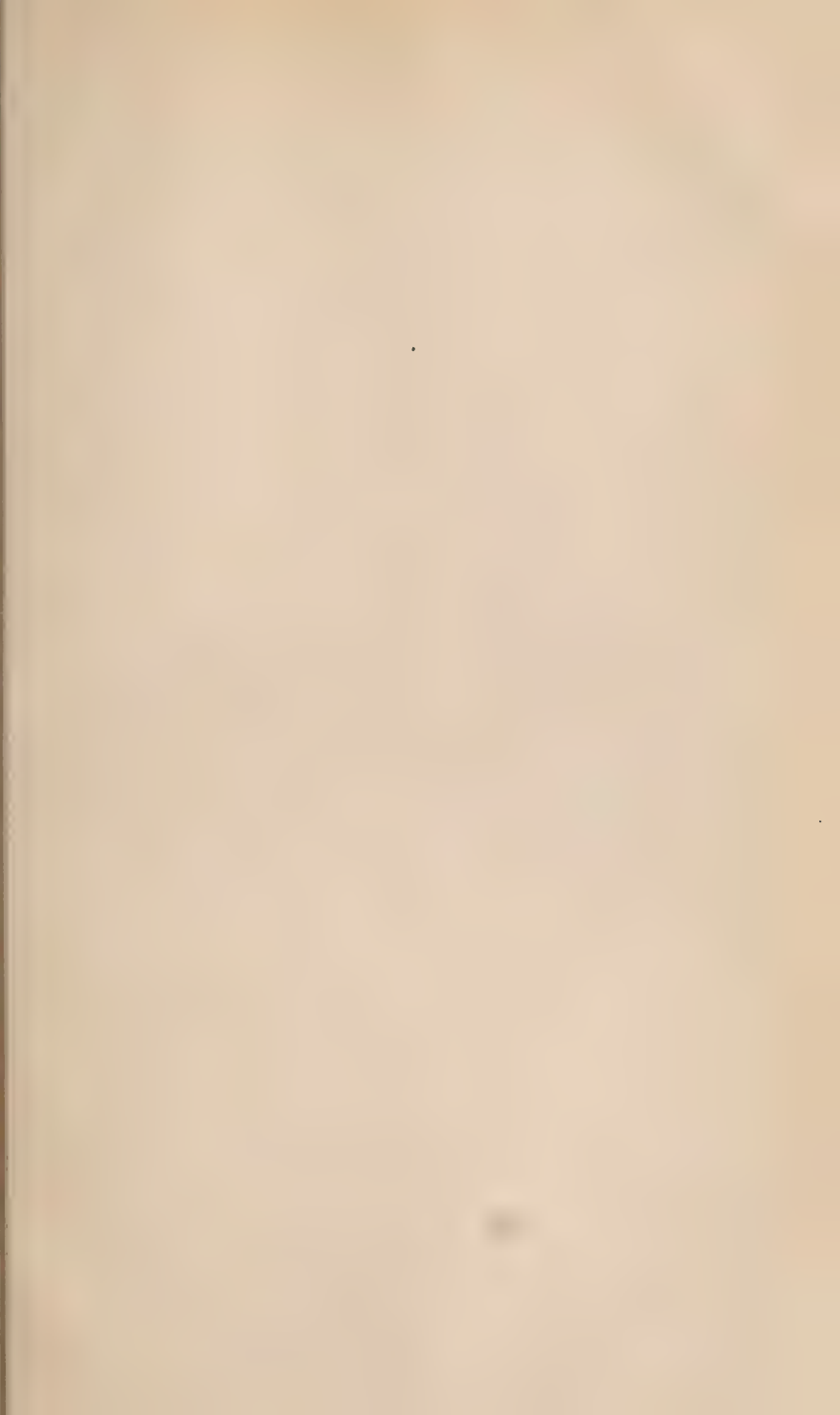
### **Honorary Members.**

Daubeny, Professor Charles, F.R.S., University of Oxford  
De Lavergne, M. Leonce  
Everett, Hon. Edward, Boston, United States  
Graham, Professor, Master of the Mint  
Hartstein, Dr. Edward, Royal Academy of Poppelsdorf  
Hofmann, Dr., College of Chemistry, 315, Oxford Street, W.  
Liebig, Dr. Justus, the University of Griessen, Hesse-Darmstadt  
Murchison, Sir Roderick Impey, Bart., Director-General of Trigonometrical  
Survey  
Napoleon III., His Imperial Majesty the Emperor of the French  
Parkes, Josiah, 11, Great College Street, S.W.  
Playfair, Dr. Lyon, C.B., University, Edinburgh  
Simonds, James Beart, Royal Veterinary College, Camden Town, N.W.  
Solly, Edward, Professor, Holme Court, Isleworth, W.  
Sprengel, Dr. Carl, Prussia  
Van de Weyer, M. Sylvian, Belgian Minister, 50, Portland Place, W.  
Voelcker, Professor, 101, Leadenhall Street, E.C.  
Way, John Thomas, 15, Welbeck Street, W.

























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